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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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VOLUME 19 NUMBER 11/JUNE 8, 1981

TABLE OF CONTENTS

AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

01 AERONAUTICS (GENERAL) 1429

02 AERODYNAMICS 1431

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

03 AIR TRANSPORTATION AND SAFETY 1434

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 1435

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications*.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 1437

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION 1439

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 1439

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

08 AIRCRAFT STABILITY AND CONTROL 1440

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 1440

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For related information see also *14 Ground Support Systems and Facilities (Space)*.

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

12 ASTRONAUTICS (GENERAL) 1442

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

13 ASTRODYNAMICS 1443

Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) 1448

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air)*.

15 LAUNCH VEHICLES AND SPACE VEHICLES 1449

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

16 SPACE TRANSPORTATION 1450

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING N.A.

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 1452

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

19 SPACECRAFT INSTRUMENTATION 1453
For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

20 SPACECRAFT PROPULSION AND POWER 1453
Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.
For related information see also *07 Aircraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

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23 CHEMISTRY AND MATERIALS (GENERAL) 1454
Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS 1454
Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY 1456
Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.
For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS 1462
Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS 1467
Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS 1470
Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.
For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

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Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.
For related information see also *Physics*.

31 ENGINEERING (GENERAL) 1473
Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS 1474
Includes land and global communications; communications theory; and optical communications.
For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

33 ELECTRONICS AND ELECTRICAL ENGINEERING 1478
Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.
For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

34 FLUID MECHANICS AND HEAT TRANSFER 1482
Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.
For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

35 INSTRUMENTATION AND PHOTOGRAPHY 1486
Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.
For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation*.

36 LASERS AND MASERS 1488
Includes parametric amplifiers.

37 MECHANICAL ENGINEERING 1489
Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY 1492
Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS 1493
Includes structural element design and weight analysis; fatigue; and thermal stress.
For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.
For related information see also *Space Sciences*.

42 GEOSCIENCES (GENERAL) N.A.

43 EARTH RESOURCES 1497
Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

44 ENERGY PRODUCTION AND CONVERSION 1504
Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation*.

45 ENVIRONMENT POLLUTION 1513
Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS 1515
Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.
For space radiation see *93 Space Radiation*.

47 METEOROLOGY AND CLIMATOLOGY 1520
Includes weather forecasting and modification.

48 OCEANOGRAPHY 1524
Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

51 LIFE SCIENCES (GENERAL) 1525
Includes genetics.

52 AEROSPACE MEDICINE 1527
Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES N.A.
Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 1531
Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY 1532
Includes exobiology; and extraterrestrial life.

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Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) N.A.

60 COMPUTER OPERATIONS AND HARDWARE 1532
Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

61 COMPUTER PROGRAMMING AND SOFTWARE 1533
Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS 1536
Includes computer networks.

63 CYBERNETICS 1536
Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support*.

64 NUMERICAL ANALYSIS 1538
Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY 1540
Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS 1542
Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS 1542
Includes topology and number theory.

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Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.
For related information see also *Engineering*.

70 PHYSICS (GENERAL) 1542
For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar Physics*.

71 ACOUSTICS 1546
Includes sound generation, transmission, and attenuation.
For noise pollution see *45 Environment Pollution.*

72 ATOMIC AND MOLECULAR PHYSICS 1547
Includes atomic structure and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS 1549
Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation.*

74 OPTICS 1550
Includes light phenomena.

75 PLASMA PHYSICS 1553
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics.* For space plasmas see *90 Astrophysics.*

76 SOLID-STATE PHYSICS 1558
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

77 THERMODYNAMICS AND STATISTICAL PHYSICS 1562
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

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Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) 1563
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81 ADMINISTRATION AND MANAGEMENT 1563
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82 DOCUMENTATION AND INFORMATION SCIENCE 1564
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS 1565
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE N.A.
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1565
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) 1566

89 ASTRONOMY 1568
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 1569
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 1570
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 1570
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 1571
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

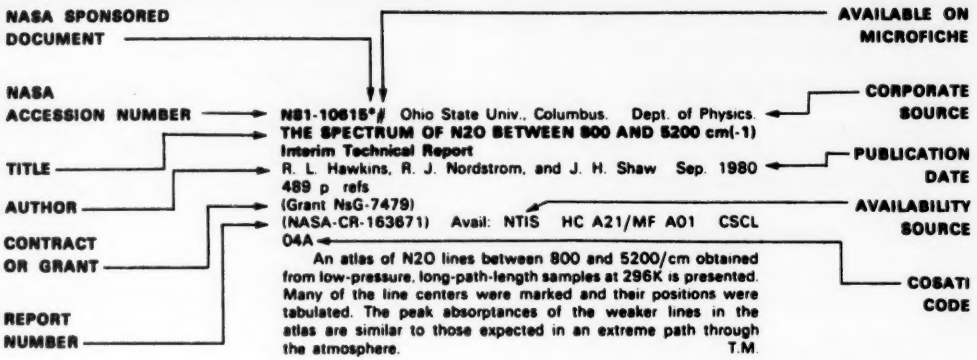
GENERAL

99 GENERAL 1571

Note: N.A. means that no abstracts were assigned to this category for this issue.

SUBJECT INDEX I-1
PERSONAL AUTHOR INDEX I-65
CORPORATE SOURCE INDEX I-73
CONTRACT NUMBER INDEX I-87
REPORT/ACCESSION NUMBER INDEX I-91

TYPICAL CITATION AND ABSTRACT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NASA ACCESSION NUMBER
N81-10615*# Ohio State Univ., Columbus. Dept. of Physics.
CORPORATE SOURCE
THE SPECTRUM OF N2O BETWEEN 800 AND 5200 cm(-1)
Interim Technical Report
TITLE
R. L. Hawkins, R. J. Nordstrom, and J. H. Shaw Sep. 1980
PUBLICATION DATE
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An atlas of N2O lines between 800 and 5200/cm obtained from low-pressure, long-path-length samples at 296K is presented. Many of the line centers were marked and their positions were tabulated. The peak absorptances of the weaker lines in the atlas are similar to those expected in an extreme path through the atmosphere.
T.M.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, LIFTING REENTRY AEROMECHANICS TECHNOLOGY

Unknown, Lockheed Missiles & Space Co. Inc., *4800 Bradford Dr., Huntsville, Alabama* 35807 (DF144980; F33615-80-C-3006)

This work unit supports lifting reentry vehicle technology. Lifting vehicles possess advantages of reduced acceleration, reduced peak heating and maneuvering flexibility over ballistic reentry vehicles. The concentration of effort over the years by government and industry on the subject of lifting reentry has identified those design methods which are appropriate. Extensive ground test and limited flight test data are available. These design methods, ground and flight test data are not readily available in a single comprehensive, optimum format for ease in design use. Therefore, the objective of this work unit is to provide such a single comprehensive, optimum format in the form of a reentry vehicle design manual. This will provide a comprehensive review of the work done to date and eliminate possible duplication.

The methods and test data will be collected, compared and arranged in a design type of manual to cover the areas of concepts, flight programs and design methods.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0002, DEVELOP A COLOR ALPHA-NUMERIC LIQUID CRYSTAL DISPLAY

J. Gunther, Hughes Aircraft Co., Aerospace Group, *Centinela Ave. & Teale St., Culver City, California* 90230 (DN081446; N62269-79-C-0356)

The Navy's advanced integrated display system (AIDS) program is to develop a totally new concept in modular cockpit instrumentation for naval air missions, requiring exploratory development of new display materials and techniques. A flat panel display with color features is directly applicable to the type of display required AIDS for the situation advisory display and the programmable panel display. This contract supports Work Unit ZA601, agency accession no. 681080.

A liquid crystal matrix display combined with a multi color filter has beeen demonstrated under a previous contract with Hughes Aircraft Co. This display module is being further developed and assembled into a system, including a symbol generater, that is to be delivered to NADC for demonstration and evaluation in the AIDS cockpit.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0003, ADVANCED TREND ANALYSIS PROCEDURES

R.L. Dehoff, Systems Control Inc., *260 Sheridan Ave., Palo Alto, California* 94306 (DF462930; F33615-78-C-2062)

To develop advanced engine deterioration trend analysis procedures for improved aircraft engine condition monitoring.

To apply advanced mathematical techniques such as system identification theory in the development of fault isolation and detection software for improved modeling, estimation, and prediction.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0004, AERONAUTICAL TECHNOLOGY, TECH AREA I - AERODYNAMICS TECHNOLOGY

I.C. Statler, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Aeromechanics Lab., *Moffett Field, California* 94035 (DA0B5001)

This project provides for technological development in rotary-wing fluid dynamics, acoustics, dynamics, stability, controllability and handling qualities where deficiencies are known to exist in meeting the requirements of future Army airmobile systems. Objectives are to develop handling quality design goals and performance criteria in terms required in future systems and to allow knowledgeable tradeoffs to be made among pilot workload, task performance and costs. This effort will lead to new design criteria and a revised handling qualities MIL SPEC for helicopters. It is intended to contribute not only to the improvement of capabilities in industry, but also to the development of the Army's in-house ability to assess the potential of new systems against predicted requirements.

These objectives will be reached through joint participation with NASA in theoretical and experimental research programs utilizing wind tunnel, ground-based simulation, and flight research capabilities.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Aeromechanics Lab.

1.0005, ADVANCED FLIGHT SYSTEMS RESEARCH

C.T. Leondes, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Engineering Systems, *405 Hilgard Ave., Los Angeles, California* 90024 (DF141870; AFOSR-79-0068)

Develop modern control technologies for application to advanced flight vehicles. Control configured vehicles will provide new dimensions in aircraft guidance and control. New flight control systems must be designed to efficiently integrate and effectively utilize the advanced capabilities of these aircraft. Basic research will be conducted to formulate a functional flight control design using optimal control and other advanced design techniques. The design will be intended for use on advanced aircraft with new control capabilities.

Conduct graduate theses research to develop the theoretical basis for advanced control systems. Modern control theories will be investigated for application to the air-to-air and air-to-ground combat problems and to precision trajectory tracking and end point attainment with environmental disturbance accommodation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0006, RELIABILITY/MAINTAINABILITY INVESTIGATION OF ADVANCED ROTOR SYSTEM CONCEPTS
U. Garganese, Kaman Aerospace Corp., *Old Windsor Rd., Bloomfield, Connecticut* 06002 (DA0G3295; DAAK51-80-C-0026)

The objectives are to develop an R&M analysis methodology for advanced rotor systems; apply the methodology to several advanced rotor concepts, identify their critical R&M issues and impact on cost, and develop recommendations for enhancing the R&M characteristics for each advanced rotor system concept analyzed.

A contract has been awarded to establish r&m and life-cycle cost characteristics of advanced rotor systems concepts. Specific areas to be investigated are reliability design procedures, repairability, manpower skill requirements, and the effect of each on life-cycle cost. The program will be accomplished in three tasks; Task I, will establish an R&M analysis methodology; Task II, will conduct a detached R&M/cost assessment of advanced rotor system concepts and Task III will update and finalize the R&M/cost assessment methodology.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0007, CRASHWORTHINESS DESIGN PARAMETER SENSITIVITY ANALYSIS
D. Lowry, Sikorsky Aircraft Co., *N. Main St., Stratford, Connecticut* 06602 (DA0G0420; DAAK51-79-C-0043)

Minimize the adverse impact of crashworthiness design criteria on the cost, weight and performance of future Army helicopter designs and identify R&D efforts required to reduce the cost and weight associated with crashworthiness requirements.

The work to be performed under this procurement shall investigate the effect of MIL-STD-1290 crashworthiness requirements on future light helicopters. Both metal and composite airframe structures shall be investigated. Trend data shall be developed for crashworthiness cost and weight as a function of helicopter weight and as a function of the level of crashworthiness specified. Crashworthiness cost drivers are to be identified to assist in determining future R&D efforts necessary to reduce the cost of incorporating crashworthiness into future helicopter designs without reducing the level of crash impact protection from that specified in MIL-STD-1290.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0008, MODIFICATION OF SURFACE PROPERTIES
J.K. Hirwonen, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN780183)

To improve the corrosion resistance and load carrying ability of aircraft bearing and gear steels by ion implantation while maintaining compatibility with MIL-L-23699B lubricants.

Implant selected ions into M50 alloy test samples then perform corrosion tests, fatigue lifetime tests, and electrochemical tests on implanted species to ascertain optimum implantation parameters.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

11.0009, RESEARCH ON SOFTWARE FOR OPTIMIZATION OF VANE AND BLEED SETTINGS IN MULTISTAGE AXIAL COMPRESSOR
J. Garberoglio, United Technologies Corp., Pratt & Whitney Aircraft Group, *P.O. Box 2691, West Palm Beach, Florida* 33402 (DF463500; F33615-79-C-2013)

The objective is to demonstrate the feasibility of devising computer software in FORTRAN language of sufficient reliability and effectiveness that it could be employed as a feedback loop in a computer controlled compressor test facility to accomplish vane and bleed optimization.

Define optimization goals and determine constraints. Develop logic relating the data available from a compressor test to a vane or bleed setting. Create the computer language to implement the logic, and demonstrate the function of the software.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0010, PACAM V INSTALLATION AND MODIFICATIONS
D.H. Schiller, A.T. Kearney & Co. Inc., *100 S. Wacker Dr., Chicago, Illinois* 60606 (DF144410; F33615-79-C-3027)

The Air Force function for this effort is to develop the methodology for assessing the potential air combat capabilities of advanced aircraft concepts. The problem is that current air combat simulation programs do not correlate with 'real world' data such as AIMVAL/ACEVAL. The objectives of this effort is to install PACAM V on the ASD CDC 6600 computer structured for the fast turn-around times necessary for parametric analyses and to modify this program to correlate with AIMVAL/ACEVAL. This would greatly increase the utility of PACAM as an engineering design tool by increasing the confidence of selecting promising technologies and concepts for further study and/or technology planning.

This effort will build upon in-house analyses done under JON 24040131 which compared PACAM II with AIMVAL/ACEVAL and identified several deficiencies in the program. The latest generation, PACAM V, will be installed on the ASD CDC 6600, structured for INTERCOM compatibility, and checked out using the sets of runs from Kirtland AFB. Runs conducted with PACAM II will then be conducted with PACAM V to identify the degree to which the deficiencies are still present. The program will then be modified to correspond with AIMVAL/ACEVAL data with check-out runs after each modification to ensure that it is functioning properly. Modifications will include tactical selection logic for vertical maneuvers, barrel roll, energy management, quick shot tactics, redefinitions of the offensive zone, and changes in cooperative tactics. The methodology used in JON 24040131 will also be used here.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0011, WIRE OBSTACLE WARNING SYSTEM (WOWS)
A. Kleider, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Avionics Research & Development Activity, *Fort Monmouth, Red Bank, New Jersey* 07703 (DA0D2824)

This program has been initiated to provide, at a cost which the Army can afford, a solution to the wire strike problem for helicopters flying nap-of-the-earth (NOE). The objectives include means of detection and recognition compatible with the aircraft lift capabilities, forward speed, and the expected incremental change in altitude required to clear the wire obstacle. The development of a flyable exploratory development model operable under restricted lighting conditions in clear weather is the prime program objective.

Recent developments in monolithic semi-conductor devices called charge coupled devices (CCD) will be exploited in a mode of operation referred to as single site activation (SSA) to detect and recognize wire obstacles. Operating in a combined electronic and mechanical scanning mode, the characteristics of wire are utilized to extract pattern recognition information. The processed video signal is converted to a visual/audible alarm with an appropriate symbolic display. Range data and low light level operation are based upon the synchronous use of a pulsed gallium arsenide (Ga-As) illuminator.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Avionics Research & Development Activity

1.0012, NOZZLE/AIRFRAME CONCEPTS FOR STOL AND SURVIVABILITY
R.L. Grossman, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF143400; F33615-79-C-3009)

Emerging requirements for future supersonic air-to-surface tactical aircraft dictate improved STOL performance and reduced observables. The objective of this investigation is to define, evaluate, and conduct feasibility analysis and tests of ad-

vanced nozzle concepts which emphasize STOL and survivability. The design criteria generated will be applicable to advanced tactical fighter aircraft to enhance overall mission effectiveness.

Conceptual design, feasibility analysis and tests of a wide range of advanced nozzle concepts, emphasizing STOL and survivability, will be conducted. IR and RCS will be evaluated to determine overall survivability.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0013, DISPERSED AND RECONFIGURABLE DIGITAL FLIGHT CONTROL SYSTEM STUDY

J. Boudreau, Grumman Corp., Aerospace Division, *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF139720; F33615-77-C-3041)

This work unit supports advanced aerospace vehicles. The advantage gained by the work unit is the increased survivability of flight control systems due to hostile fire. The objective of the work is to develop strategies to increase aircraft survivability by dispersing and/or reconfiguring the flight control system. The development of these strategies should reduce the total number of components required to perform the flight control function, reduce the logistics cost in maintaining flight control systems, and significantly increase the survivability of military aircraft.

Analyze the dispersion of sensors about the airframe with appropriate structural filtering. Compare the use of multiple control surfaces to perform the flight control functions with the use of multiple actuators on single surfaces. Analyze the advantages of dispersing micro-processors about the airframe. Compare the use of a central processing computer with dispersed and non-dispersed mirco-processors for synchronization, monitoring of failures, and size required. Develop reconfiguration strategies for detectable sensor failures, surface failures, and computer failures. Determine how to isolate where the failure occurred and what mode of reconfiguration to use (i.e., switch the bad unit out, switch to a redundant unit, approximate the function using other non-redundant units, or switch to a back-up mode).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0014, ROTOR DYNAMIC RESPONSE

T. Smalley, Mechanical Technology Inc., *968 Albany Shaker Rd., Latham, New York* 12110 (DF460400; F33615-79-C-2050)

Develop and apply advanced techniques for reducing aircraft engine rotor vibration. Provide an experimental data base for the development of analytical models to be used to minimize turbine engine vibration.

Improve upon turbine engine rotor design by analytically predicting and experimentally verifying the influence of damping systems on the stability of an engine rotor system at its critical speeds.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0015, EXHAUST EMISSIONS INVESTIGATIONS

W.S. Blazowski, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF458240)

This effort is intended to provide limited scope investigations which utilize unique AFAPL capabilities to further the understanding of aircraft engine exhaust problems. Specific goals are (a) establishment of the hydrocarbon composition of aircraft engine exhausts, (b) determination of the NOX emission reduction potential of manganese and iron containing fuel additives during supersonic cruise combustor operation, (c) investigation of emission reduction by the use of variable geometry in a F101 combustor sector rig, and (d) study of low-pressure-ratio afterburning engine emission problems.

A 200 lb thrust expendable engine is under development. The engine utilizes turbo-machine components from commercial truck turbochargers, and has a sudden expansion type afterburner based on ramjet ramburner technology. A production cost estimate will be made for the engine.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0016, PRESIMULATION AND ANALYSIS PLANNING OF DYNAMIC SYSTEMS

D.A. Dick, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF130000)

In order to support the evaluation and development of military aerospace vehicles, such as the F-15, B-1, A-X, etc., it is necessary to provide complete simulations which will accurately represent the visual and motion cues associated with the full scale vehicles. The moving base hybrid simulation of these military vehicles requires detailed planning and analysis in order to utilize the simulation facilities effectively. The objective of this effort is to conduct pre-simulation and analysis planning efforts which will lead to more detailed analysis and/or simulation programs. The effort will determine whether weapon system problems studied require detailed analysis and/or simulation. This will eliminate costly simulations where they are not warranted, and will insure maximum utilization of Air Force resources.

To accomplish the stated objective, the following specific work will be performed: (1) Update, collect, maintain and enlarge the present cost/performance/risk data base in all areas applicable to AFFDL efforts. (2) Evaluate adaptability of existing analytical methodologies, cost estimating techniques and cost models for application to AFFDL peculiar cost problems. Utilize information derived to alter, revise or change these for effective application. (3) Generate new parametric costing techniques and new cost estimating relationships. This requires development of mathematical and statistical analysis models and techniques, tailored to specific AFFDL requirements. Continuing in-house effort will require obtaining knowledge relative to emerging AFFDL technologies which are being integrated into advanced concepts and the development of some means to combine these to obtain realistic cost estimates. (4) Formulate analytical tests capable of determining the degree of validity implicit in these mathematical and statistical models and the accuracy and adequacy of the methods developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0017, ATMOSPHERIC ELECTRICAL HAZARDS TO AIRCRAFT

G.A. Dubro, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141930)

More sophisticated electronic systems and advanced structural materials are being used in USAF aircraft, which will require hardening to the natural atmospheric electricity hazards (AEH) environment. Research is required to evaluate the susceptibility of these systems and materials. This effort will provide a data base to be used for the evaluation of the susceptibility of aircraft to the deleterious effects of the AEH environment and provide the technology for evaluating and hardening these systems and materials to this natural environmental threat. The data generated from this work effort will be used by the Air Force to define the natural AEH environmental threat, to provide the basis for development of test techniques and facility designs for assessing aircraft systems and materials to the AEH environment, and to assist in the development of design guides for hardening aircraft systems and materials to the AEH enviromental threat.

The approach will be to conduct flight programs to measure and define the natural AEH environment and its effects on electronic systems. Ground test facilities will be developed and experimental test techniques to simulate and assess the susceptibility of aircraft systems to the AEH envionment will be developed, refined and validated. The data generated from these programs will be documented in the form of guides describing the characteristics of the natural AEH environment, specifications for test techniques and simulation facilities, and inputs into design guides for hardening aircraft systems to the natural AEH environment.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0018, STABILITY AND CONTROL DATA DISCREPANCIES IDENTIFICATION
S.F. Lash, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143300)

This work unit supports TPO 3, Flight Control, and major thrust FG02D3, Aircraft Stability and Control Prediction. Specifically, it addresses the problem area involving the differences observed between predicted and actual flight characteristics. The objective of this effort is to identify discrepancies observed during aircraft development programs between predicted values of stability and control parameters and those measured in flight. The results of this effort will be used to formulate a specific investigation of the test and analysis methods used to predict stability and control characteristics, which, will result in a more accurate mathematical representation of predicted aircraft dynamics.

Information will be obtained on several recent and ongoing aircraft development programs to identify situations where values of the stability and control parameters used for dynamic analysis and piloted simulation have led to misleading estimates of actual flight characteristics. Following problem identification and selection, aerodynamic data, piloted simulation time histories, flight test time histories, and operational experience will be evaluated to document discrepancies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0019, AERODYNAMIC TECHNOLOGY ANALYSIS METHODS
D.E. Shereda, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF144710)

The efficient design of advanced high speed flight vehicles requires the early determination of their aerodynamic characteristics with reasonable levels of accuracy. Experimental testing programs are expensive and somewhat limited in scope. Analytical methods are inexpensive but are accurate only within narrow limits of the assumptions made in the development. This effort seeks to expand these limits for high speed aircraft and missile configurations through the evaluation, modification and development of analytical techniques. This will result in greater analytical capability for independent assessments and impact T&E resource utilization.

Recently developed analysis methods will be exercised, evaluated and improved for accuracy and ease of application. Comparisons of test data on advanced configurations with the latest analysis methods will provide insight into their shortcomings. New methods will be developed in the areas of unsatisfactory correlations with flight and test data. The effort will be primarily analytical relying on experimental data obtained in other programs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0020, AERODYNAMIC PROPERTIES OF EJECTING CREWMAN
B.J. White, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF140240)

To increase the probability of crewmember survivability during in-flight emergencies through providing more effective emergency escape subsystems. Solutions will be identified for the current operational problem of a high incidence of aircrew injuries due to limb flailing. Aerodynamic forces acting on the crewman during ejection from aircraft flying at transonic and supersonic speeds will be determined. Design criteria will be established to form a basis for concept assessment and equipment designs to provide crew protection during emergency escape from high speed combat aircraft.

This study will integrate and expand on previously developed methodology provided by the Air Force contract F33615-75-C-3103 and will support the development of the structural technology evaluation program. The model will use the industrial engineering standards approach which will generate the desired confidence and provide a high quality cost estimate.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0021, A/C FUEL TANK WALL RESPONSES TO HYDRODYNAMIC PRESSURES
S.J. Bless, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (DF140810; F33615-77-C-2082)

Combat survivability is a factor in developing an effective weapon system. A major cause of combat losses is the high vulnerability of aircraft fuel systems to nonnuclear threats. Aircraft fuel cells are susceptible to catastrophic fracture and rupture due to the intense pressure pulses immediately following impact by a ballistic projectile. The objective of this effort is (1) to develop a thorough understanding of the phenomenon (hydrodynamic ram) that causes this catastrophic damage and (2) to develop design criteria for combat-aircraft fuel-cells which can be used to inhibit or negate this damage, thus minimizing the vulnerability of the fuel tanks.

An analytical and experimental program will be conducted with a thorough analysis of each significant event beginning with projectile impact and continued as long as the resulting pressure pulses are intense enough to cause fuel-tank-wall catastrophic rupture/fracture/failure. Existing computer models will then be reviewed and/or modified for assessment methodology. Finally, the computer models will be used to develop families of design curves and design criteria which can be used to design aircraft fuel-tanks to inhibit or negate catastrophic failures resulting from the hydrodynamic ram phenomenon.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0022, AFAPL SENIOR INVESTIGATOR PROGRAM
J.D. Pinson, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (DF461700; F33615-77-C-2069)

The objective of the AFAPL Senior Investigator Program is to obtain assistance in solving complex and persistent problems involving airbreathing propulsion (turbine engine and ramjet engine), aviation fuels and lubrication, fire protection, and related systems and materials.

A separate and specific task is established to perform work for each individual area of study when a need is identified. Principal investigator is responsible for assigning a senior investigator to perform each task.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0023, FEASIBILITY OF A MULTI-PURPOSE DYNAMIC CREWSTATION CONCEPT
R.J. Crosbie, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN181021)

To prove feasibility of a multipurpose dynamic crew station which can efficiently be reconfigured to provide a realistic and crew acceptable dynamic test bed in which problems related to crew performance of current and future aircraft weapon systems designated for the 1980-1990 time span can be investigated in their operational environments. The crew station will initially be configured as an F-14 aircraft, be specifically designed for insertion into the gondola of the NAVAIRDEVCEN centrifuge with buffet compatibility, and will be tied in through high quality transmission lines with the proposed center's system integration lab.

This multidirectorate development effort includes (1) the design and fabrication of a crewstation which will retain basic commonality of advanced aircraft with provisions for effecting changes necessary to simulate a large variety of aircraft (first configuration F-14). The crew station will be capable of accommodating numerous forms of instruments, displays, flight controls, seats, restraint systems, etc., and of different dimensional requirements for down vision, panel width, panel reach, and structural width. Also included in this effort is (2) the integration of an out-the-window visual display system and variable force feel control stick both acquired under other auspices, (3) the identification, refinement, and verification of various software tasks to control and operate the cockpit equipment, (4) the development of a cockpit computer wiring distribution scheme,

and (5) the demonstration and evaluation of the multipurpose crewstation.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0024, RADAR TECHNIQUES FOR AIR FORCE APPLICATIONS IN AVOIDANCE OF BIRD-AIRCRAFT COLLISIONS AND IMPROVEMENT OF FLIGHT SAFETY

S.A. Gauthreaux, Clemson University, School of Physics Mathematics & Biological Sciences, Dept. of Geology, *Long Hall, Clemson, South Carolina* 29631 (DF031120; AFOSR-79-0038)

AF function - bird strikes continue to pose a major hazard to aviation, especially to high speed low altitude missions. Optical techniques offer the most promising approach to reduce the number of collisions. An electro-optical system for detecting and characterizing aloft bird concentrations is needed. Deficiency - the development of direct visual and radar techniques for detecting and monitoring hazardous concentrations of birds aloft is needed. Objective - the objectives of this research are 1) to accurately describe and quantify the various types of bird echoes that may appear on the radar screen during day and at night and identify the types of birds responsible, and 2) to further examine the feasibility of using an image intensifying device (direct viewing or closed circuit television camera) to detect and quantify hazardous concentrations of birds from the ground and from the cockpit of an aircraft. How research contributes - this research will result in new optical methods for detecting concentrations of migrating birds at night. The use of such devices will hopefully reduce the occurrence of bird-aircraft collisions and directly contribute to RO 1.4.2.

An image intensifier in combination with a closed circuit television camera will be used to monitor and quantify nocturnal bird migration. Bird echoes displayed on airport surveillance radars will be correlated with simultaneous direct visual studies to identify and quantify bird species hazardous to aircraft.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0025, WIND TUNNEL EVALUATION OF AN AEROELASTICALLY CONFORMABLE ROTOR

L.R. Sutton, Systems Research Lab. Inc., RASA Division, *1055 J. Clyde Morris Blvd., Newport News, Virginia* 23602 (DA0E3777; DAAJ02-77-C-0046)

Investigate the ability to improve rotor operational qualities (i.e., performance, efficiency, loads, stability and handling qualities) by deliberately designing aeroelastic properties to exploit the inherent tendency for blades to deform elastically. Determine if significant practical improvement can be made in rotor operational qualities, reliability and maintainability, and cost. This effort will be directed toward generation of advanced data pertinent to advanced Army aircraft, including UTTAS, AAH, and ASH.

Conduct thorough review of effects of aeroelastic properties on rotor operational qualities. Select specific significant parameters and objectives which can be evaluated with existing technological capability. Perform rigorous phenomenological studies of the results of parameter variations using advanced analytical tools. Design and fabricate wind tunnel models, and perform comprehensive tests to substantiate analytical findings. Carefully review results to determine specific parametric trends for improving rotor design. Where practical, interpret trends in terms of full scale design characteristics which may be applied in aircraft development.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0026, HT RM 78-02 - DESIGN AND FABRICATION OF EXPERIMENTAL TEST HARDWARE - EXTERNAL CARGO OPERATIONS

J.A. Vichness, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3808)

To improve the capabilities of helicopters in performing external cargo operations in tactical and logistical support missions.

Utilizing a contract-support house task, design analyses of contractor and in-house identified technologies will be conducted in relation to overall aircraft systems and current/future combat support concepts. In-house efforts will utilize the facilities of the ATL, structures (wind tunnel), and AERO Laboratories and experimental flight hardware for verification of selected technology concepts and to identify technology voids.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0027, NAVY VEHICLE DESIGN AND CONSTRUCTION - AERODYNAMIC CHARACTERISTICS OF WINGS WITH SEPARATED FLOW

B. Maskew, Analytical Methods Inc., *110 116th Ave. S.E., Bellevue, Washington* 98004 (DN875208; N00014-78-C-0128)

The maneuvering capability of modern fighter aircraft is most often limited by heavy buffet and/or loss of control, both due to flow separation on the aircraft wings. Consequently, the consideration of flow separation in the design and analysis of wings is extremely important. Unfortunately, the exact theoretical computation of these complex flowfields does not appear possible in the foreseeable future. Current linear flow models are not applicable for separated flows. In addition, wind tunnel tests are extremely expensive and often come too late in the design cycle to impact major aerodynamic/structural design trade-offs. It is the objective of this research to develop an approximate numerical model of the flow on three-dimensional wings that will permit computation of the aerodynamic characteristics including the effects of flow separation.

An approximate viscous flow method will be developed to predict areas of separation on the wings. The separated flow region and resulting wake will be modeled using a potential flow code. An iterative procedure will be used to model the viscous/inviscid flow interaction. The basic procedure has already been used very successfully for two-dimensional flows on airfoils. Both leading- and trailing-edge flow separation are being incorporated into the model.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0028, EVALUATION OF BLADE TIP PLANFORM EFFECTS ON HOVER PERFORMANCE - ARMY HELICOPTER

M. Summa, Analytical Methods Inc., *110 116th Ave. S.E., Bellevue, Washington* 98004 (DA0D4081; DAAJ02-76-C-0069)

To develop a mathematical analysis, based on lifting surface theory, for the prediction of helicopter rotor performance in hover and in a vertical climb.

Portions of existing analyses will be modified and combined to provide an analysis capable of modeling rotor blades with arbitrary radial variations in planform, twist, and airfoil section. The analysis will be based on the vortex lattice method and will include a free wake analysis, a boundary layer analysis, and representations of blade thickness, flow viscosity, and flow compressibility effects. This analysis will be used to predict C sub P - C sub T curves and blade loading distributions to be correlated with existing test data and to be compared with the corresponding predictions from a lifting-line analysis and a blade element momentum analysis.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0029, ADVANCED FIBER REINFORCED THERMOPLASTICS %AFRTP FOR AIRCRAFT STRUCTURES

J.T. Hoggatt, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF136020; F33615-76-C-3048)

Although significant advancements have been made in reducing the weight of aircraft structures through the use of advanced composites, further reductions in ownership and especially acquisition costs are potentially available through the sub-

stitution of thermoplastic matrix materials for the present thermosetting matrix materials (such as epoxies). Flat thermoplastic laminates can potentially be laid up and consolidated with highly automated processes, they can be stored without refrigeration as long as necessary (as can the thermoplastic adhesives) and they can then be postformed into complex shapes by applying heat and pressure. In addition, the thermoplastics can be welded in seconds either ultransonically or with an electromagnetic vibration welding technique. The objectives of the program are (1) to demonstrate the potential of advanced fiber reinforced thermoplastics (AFRTP) to reduce the fabrication and assembly costs of aircraft structures, (2) to demonstrate the structural integrity and durability of an AFRTP component and (3) to simplify the repair procedures and reduce the cost of maintaining advanced composite structures.

The approach to attaining the objective is to select a structural component from either an operational system or a future production system, redesign the component, develop the manufacturing and repair techniques, manufacture the component and thoroughly test it. The selection of the demonstration article is restricted to a component that has a definite potential for acquisition cost savings and/or reduction in maintenance costs on an operational or future production aircraft. This program is sponsored jointly by the Manufacturing Technology Division of the AFML and the Structures Division of the AFFDL.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, HIGH TEMPERATURE OXIDATION AND MECHANICAL PROPERTIES OF SILICON NITRIDE
D.D. Cubicciotti, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (DF044600; F44620-76-C-0116)

AF function - ceramic turbine engines for remotely piloted vehicles (RPV) and auxiliary power units (APU) are being developed by the Air Force, Army, Navy and NASA. Deficiency - there is a deficiency in the present knowledge of the response of these materials to degradation in hostile turbine environment over extended time periods. Short time exposure experiments look encouraging, however, there is a need for careful study into the degradation of mechanical properties as a result of chemical attack in turbine atmospheres. Objective - this research seeks to establish fundamental understanding of the chemical and mechanical behavior of hot pressed silicon nitride in load-bearing turbine environments. How work contributes - this important data is required in order to establish the design allowables for ceramic turbine engine development.

The relationship of corrosion and chemical diffusion to mechanical properties of various hot pressed silicon nitrides will be determined. Detailed chemical and microstructural analysis will be correlated with time, temperature, atmosphere and stress exposure. The resultant changes in mechanical strength will be related to the growth rate of the reacted microstructure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0002, INTERFEROMETRIC DOPPLER ANEMOMETRY
R.G. Weiss, Georgetown University, School of Arts & Sciences, Dept. of Chemistry, *3800 Reservoir Rd. N.W., Washington, District of Columbia* 20007 (DN980411)

To develop air path and fiber interferometers and apply them to Doppler anemometry. Resulting instrument to be used to measure flow rates in combustion processes.

Air path and fiber interferometers will be constructed at the Naval Research Laboratory. The resulting F-rings patterns will be projected through gas flows in order to measure flow rates from processes of interest.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0003, PRESSURE SENSITIVE PLASTICS
M.G. Broadhurst, U.S. Dept. of Commerce, National Bureau of Standards, *Washington, District of Columbia* 20228 (DN223239; N00014-80-F-0003)

The Navy is a large user of piezoelectric (pressure-sensitive) devices for detecting acoustic signals. Certain plastics have been found to exhibit piezoelectric activity and have the advantage that they can be formed into thin films and other shapes which are impractical for ceramic piezoelectrics. It is the purpose of this research to understand the piezoelectric phenomenon in plastic materials and to find means for enhancing it to make practicable their use in instruments for detecting pressure changes.

A suitable theoretical model for piezoelectricity in polymers will be developed and experimentally tested. A relationship will be sought between molecular structure and motions and the piezoelectric phenomenon. An attempt will be made to optimize the piezoelectric effect. An investigation of the relationship of pyroelectricity (thermal effects) to piezoelectricity (mechanical effects) is part of this research.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0004, BASIC STUDIES OF THE METALLIC STATE
A.C. Ehrlich, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN620110)

To establish a theoretical basis for predicting and understanding alloy formation and metallic behavior of naval device materials for electronic and magnetic applications such as those used for computer memory elements, electronic magnetic shielding and communications components.

To accomplish these objectives, investigations of electronic, thermal and magnetic properties of unique alloys are being conducted. RF response of communciations materials are being examined. Mathematical and computer techniques are employed to analyze the results in terms of quantum mechanical principles. A theoretical framework for predicting alloy formation and metallic behavior is the ultimate objective.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0005, ION BEAM MODIFICATION OF MATERIALS
J.W. Butler, U.S. Dept. of Defense, Navy, Naval Research Lab., Radiation Technology Div., *Washington, District of Columbia* 20375 (DN080205)

To develop techniques involving ion implantation (I) that may be used to produce electronic devices with large depletion depths, reduced surface effects, improved characteristics, and/or multilayer structures and (II) that modify optical materials to obtain certain properties, such as optical wave guides and optical filters.

Extend the usual range of implanted ions to deeper (micrometer) depths by means of a Van de Graaff accelerator and then make electronic, optical, and other measurements to optimize parameters and procedures.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0006, STRUCTURAL PLASTICS DESIGN MANUAL
Unknown, U.S. Dept. of Transportation, Federal Highway Admin., Office of Development, Implementation Div., *400 7th St. S.W., Washington, District of Columbia* 20590 (IAA-H-68-76)

To provide a manual detailing the specialized knowledge and skills required for structural design using plastics. The manual will be based on existing state-of-the-art and is intended to aid in transferring technology developed by chemists, chemical engineers, materials fabricators and specialized industries to engineers concerned with structural design. It is anticipated that the manual will be used by structural, mechanical and civil engineers. Typical application areas will be mass transportation, housing, automotive, aerospace, consumer products, chemical industry and the data processing industry. The manual is to provide an overview of design considerations and structural concepts inherent in the use of plastics materials, as well as practi-

cal design procedures and aids for structural engineers unfamiliar with the specialized engineering practices needed for quantitative design of structural components using these materials. Design approaches which lead to the efficient utilization of plastics for structural applications will be explained and illustrated with design examples. Technical presentation will be directed to engineers and structural designers having a basic education in strength of materials and structural design, but without specialized knowledge of plastics and reinforced plastics.

SUPPORTED BY U.S. Dept. of Housing & Urban Development, Office of Policy Development & Research

3.0007, INVESTIGATE VANADIUM AND HOT CORROSION RESISTANCE OF CHROMIUM AND SILICON BASED COATING SYSTEMS

R.J. Hecht, United Technologies Corp., Pratt & Whitney Aircraft Group, *P.O. Box 2691, West Palm Beach, Florida* 33402 (004553 TICNO; 72B490)

Laboratory furnace corrosion testing of bulk coating specimens will be performed in environments modeling those present in the turbine section of gas turbine engines using crude, residual, and blended fuel oils. Materials will be advanced overlay coatings which form protective oxide scales based on chromium and silicon oxides. Testing will be done at various temperatures with various levels and compositions of V2O5, Na2SO4 and mixed salt deposits in air or prepared atmospheres containing gaseous V2O5 and SO3. High temperature particulate erosion testing will also be performed. The objective is the identification of a coating material which will prolong the durability of gas turbine engines operating with low-grade fuel oils.

SUPPORTED BY U.S. Dept. of Energy, San Francisco Operations Office

3.0008, MOLECULAR BEAM EPITAXY OF HG1-XCDXTE (17036-EL)

D.W. Covington, Georgia Inst. of Technology, Engineering Experiment Station, *225 North Ave. N.W., Atlanta, Georgia* 30332 (DA0G3042; DAAG29-80-K-0012)

To grow superior device quality mercury-cadmium-telluride crystals via molecular beam epitaxy. Relevance: HgCdTe materials research is highly relevant to ongoing NVEOL programs and is strongly encouraged by aged.

To assemble a quartz MBE system, to study laser assisted epitaxy, to establish control of deposition parameters, to characterize crystal structure and composition, electrical and optical properties, to study effects of annealing, and to investigate the role of dopants.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0009, METALLURGICAL CHEMISTRY FOR DURABILITY

L.H. Bennett, U.S. Dept. of Commerce, National Bureau of Standards, Center for Materials Science, *Rte. 270, Gaithersburg, Maryland* 20234 (56445)

OBJECTIVE: Develop and verify predictive models for alloy phase stability and metastability as part of the ASM/NBS phase diagram program. Develop in 5 years a computer system including graphics for predictive modeling of alloy phase diagrams for interactive use based on experimental data and thermodynamic and quantum mechanic principles. Determine phase stability, apply advanced measurement methods and produce critical data. Test system on light alloys, aluminum and titanium, used in transport, and marine industrial rapidly solidified metallic glasses.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards, Center for Materials Science

3.0010, INTERDISCIPLINARY MATERIALS RESEARCH

M.S. Dresselhaus, Massachusetts Inst. of Technology, School of Engineering, Dept. of Materials Science & Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DMR78-24185)

Cooperative research programs, involving faculty from six academic departments, will be continued in the following major areas: (1) Flow and Fracture in High Temperature Alloys - with the objective of determining the basic factors involved in these processes, thus permitting longtime extrapolation of behavior from short-term tests, making possible improved prediction of useful life. (2) Deformation and Fracture in Polymer-Based Composite Materials - including polymer-ceramic composites. (3) Microcrystalline and Glassy Alloys - with emphasis on consolidation processes and on mechanical/corrosion properties. (4) Platinum Surfaces and Catalysis - with emphasis on the role which surface alkyls and/or the substrate play in the heterogeneous catalysis processes on platinum surfaces. (5) Phase Transitions - with emphasis on multicritical points. (6) Optical Materials - with emphasis on materials and properties of technological potential.

This program is a continuation of DMR76-80895 AO2, with further strengthening of the cooperative and interdisciplinary aspects. The award is for the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0011, DEFECTS AND CONDUCTION MECHANISMS IN NONSTOICHIOMETRIC METAL OXIDES

H.L. Tuller, Massachusetts Inst. of Technology, School of Engineering, Dept. of Materials Science & Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DMR78-26206)

The purpose of this research program is to identify the predominant ionic and electronic defects formed during the reduction and/or doping of tantalum pentoxide (Ta205) and to establish their role in both charge and mass transport. To this end well characterized poly and single crystalline specimens will be fabricated both in pure and doped form. A chemical vapor deposition (CVD) apparatus has been assembled for single crystal growth which will be capable of growing both pure and intentionally doped crystals.

The defect chemistry of pure and niobia-doped Ta205 specimens will continue to be studied as a function of temperature, oxygen partial pressure, dopant additions and structure. Other measurements to be implemented include thermoelectric power, transference number and composition-change measurements. The latter are to be performed with a novel technique being developed under this program which will be capable of measuring composition changes substantially below other available techniques. Defect modeling of Ta205 doped with variable valent impurities is expected to lead to predictions with respect to the degree of oxygen deficiency and to the oxygen partial pressure dependencies of the defect species expected.

This is a continuation of research initiated under NSF DMR76-21625, and is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0012, EVALUATION OF MATERIALS FOR FREE DROP CONTAINER (FOOD AND WATER)

R. Vernet, U.S. Dept. of Defense, Army, Natick Research & Development Command, *Natick, Massachusetts* 01760 (DA0H4281)

This development will provide an end item to replace the standard container (FSN 1670-832-5917) which is no longer available.

The approach will consist of replacing the presently used prohibited modified polyurethane material with a suitable film substitute which must be developed under this program.

SUPPORTED BY U.S. Dept. of Defense, Army, Natick Research & Development Command

3.0013, RADIATIVE COLLISIONS

J. Weiner, Dartmouth College, School of Arts & Sciences, Dept. of Chemistry, *P.O. Box 833, Hanover, New Hampshire* 03755 (DN575345; N00014-78-C-0823)

The technical objective of this effort is to study laser-induced ionizing and reactive collision processes under molecular beam conditions. This work is important to the Navy because it may have applications to the chemistry occurring in the upper atmosphere, electric discharge lasers, and combustion and flame phenomena.

The approach involves a basic experimental arrangement in which two crossed particle beams (atom/atom or ion/atom) interact with a third beam from a laser. All three beams are in one plane. Ions produced in the interaction region are mass analyzed and detected by a particle multiplier. Ion yields are measured as a function of atomic mass, laser frequency, and laser intensity. Provision is made for a second laser such that the first laser pumps an excited level of one or both of the colliding partners, while the second laser provides the nonresonant optical radiation which is absorbed by the colliding system to produce the final ion products.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0014, LASER MASS SPECTROMETRY - VIBRONIC/ MASS SPECTROSCOPY VIA MULTIPLE PHOTON IONIZATION OF POLYATOMIC MOLECULES

R.B. Bernstein, Columbia University, Undergraduate School, Dept. of Chemistry, *Broadway & W. 116th St., New York, New York* 10027 (CHE78-25187)

This research is in the area of Quantum Chemistry; it involves molecular beam techniques. Dr. Bernstein plans to design and construct a laser mass spectrometer (LAMS) to make possible fundamental studies of vibronic/mass spectroscopy via multiple photon ionization (MPI). The LAMS technique combines the specificity of MPI vibronic spectroscopy with the generality of the mass spectrometric method. The new instrument will be used to investigate the basic process of multiple photon excitation, ionization, and, most important, fragmentation of polyatomic molecules. Several series of prototype molecules with different, archetypical electronic structures are to be investigated. The goal is to gain a detailed understanding of the mechanism of the stepwise absorption of visible (and UV) photons by polyatomic molecules, which lead ultimately to ionization and dissociation into charged and neutral fragments. The ionization-fragmentation NPI pattern also provides important information necessary for the unambiguous interpretation of 'conventional' ion current NPI spectra, as obtained in gas cells. The laser mass spectrometer (LAMS) can be used as a research instrument (i.e., to measure vibronic energy levels and investigate the electronic structures of excited states of molecules and radicals) as well as an analytical tool (i.e., for the identification of chemical compounds, analysis of mixtures and isotopic assay). Numerous applications of LAMS to basic chemistry are to be explored.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0015, UNITARY GROUP METHODS FOR THE ELECTRON CORRELATION PROBLEM

I. Shavitt, Battelle Memorial Inst., *505 King Ave., Columbus, Ohio* 43201 (CHE78-25191)

This grant supports research in the Quantum Chemistry Program for further developing and testing a new approach to studying the electronic structure of molecules. The new method is the graphical form of the unitary group approach for the calculation of correlated electronic wave functions of molecules. The initial implementation is to be for direct configuration interaction treatments. Several possible improvements and extensions are to be considered, including a more general treatment of point-group symmetry, improvements in the evaluation of two-electron integral contributions, and extensions to perturbation theory and coupled cluster techniques. The graphical unitary group approach offers a very powerful formalism for highly efficient treatment of the electron correlation problem.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0016, SURFACE-STRENGTHENING MECHANISMS IN REACTION-SINTERED SILICON NITRIDE AND MIXED MODE SUBCRITICAL CRACK GROWTH

M.G. Mendiratta, Systems Research Lab. Inc., *500 Woods Dr., Dayton, Ohio* 45432 (DF049810; F49620-77-C-0124)

AF function - ceramic turbine engines for remotely piloted vehicles (rpv) are being developed for greater cost savings and higher performance. Deficiency - the reaction sintered silicon nitride (RSSN) offers an attractive opportunity for cost savings in manufacturing, however, strength and oxidation resistance is marginal because of its open pore structure. Hot-pressed silicon nitride (HPSN) on the other hand is dense and strong but may be further toughened by controlling its microstructure. Objective - the objective of this research is to increase the strength and toughness of RSSN and HPSN and to enhance the oxidation resistance of RSSN. How work contributes - the acceptance of silicon nitride in critical applications of a turbine engine will be dependent upon strength, toughness, and chemical resistance in severe environments.

This research will seek to improve both the oxidation resistance and the strength of RSSN by surface modifying treatments (e.g., preoxidation) and by coatings (e.g., dense vapor-deposited silicon nitride). Crack-branching mechanisms will be studied in HPSN in order to improve high temperature strength and toughness through controlled microstructure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0017, REINFORCED THERMOPLASTIC SECONDARY STRUCTURE

D.J. Hoffstedt, Boeing Co., Boeing Vertol Company, *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DN890259; N00019-80-C-0154)

Investigate application of thermoplastic composite materials for secondary structure of Navy/USMC CH-46 helicopter.

Conduct conceptual design trade study, composite materials selection, element testing, and preliminary design/analysis of CH-46 foreward pylon clamshell doors. Based on this study a prototype tooling, fabrication and inspection plan will be developed as well as detail designs of clamshell door elements and assemblies.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0018, EXPERIMENTAL AND MODELING STUDIES OF HIGH TEMPERATURE COMBUSTION (15826-C)

R. Zellner, University of Texas, Austin Campus, Graduate School, *200 W. 21st, Austin, Texas* 78712 (DA0F9262; DAAG29-78-G-0174)

Investigations will be conducted on fuel profiles of small hydrocarbons, mostly in fuel-rich mixtures, heated to reaction temperature in reflected shocks and on product profiles from hydrocarbon and carbon disulfide combustion in both reflected and incident shock waves. Relevance: This research will contribute to Army programs in ignition and combustion. In particular it will provide data vital to the improvement of fuel-air explosives. Contributions to the further development of the carbon disulfide plus oxygen flame laser are also expected.

Shock tube techniques, laser-schlieren, IR laser-absorption spectrophotometry, IR thermal emission, and computer analysis techniques will be brought to bear on the problems under investigation.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0019, QUANTUM THEORY OF ENERGY TRANSFER IN CHEMICAL REACTIONS
R.E. Wyatt, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Chemistry, *200 W. 21st St., Austin, Texas* 78712 (CHE78-08703)

Dr. Wyatt intends to carry out a quantum mechanical study of three-dimensional atom-diatomic molecule collision processes. Accurate and model studies of energy transfer are planned for both electronically adiabatic and electronically nonadiabatic collisions. Extensive close-coupling studies of vibration-rotation energy transfer are planned for the electronically adiabatic F plus H2 reaction. Distorted-wave and Franck Condon overlap models of resonance structure in chemical reactions will be investigated. For electronically nonadiabatic collisions detailed analysis of the structure and symmetry of electronic-rotational energy correlation diagrams will be carried out as a first step. Then, close-coupling studies of electronic nuclear energy transfer in reactive F(2P) plus H2 and nonreactive C ion (2P) plus H2 collisions will be made. Distorted-wave and overlap models will be extended to specific problems in the theory of electronic-nuclear energy transfer. These new results will provide a much more detailed understanding of how energy is transferred in chemical reactions.

This research represents a continuation of that currently supported by Foundation Grant CHE-7600186.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0020, ENERGETICS OF IONIZATION AND EXCITATION PROCESSES (14343-C)
J.P. Simons, Utah Higher Education System, University of Utah, School of Science, Dept. of Chemistry, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DA0F9073; DAAG29-77-G-0193)

To investigate the electronic stabilities and charge densities of gas phase negative molecular ions and to explore the effects of solvating molecules on these properties. Work on the binding of electrons to highly polar molecules will also be included. Relevance: Results will provide insight into the importance of electronic transitions during deflagration and detonation processes. Further, quantum chemical calculations on atmospheric and stratospheric anions will have application in modeling programs ongoing at ASL.

The equations-of-motion technique, an ab initio quantum mechanical method that treats charge relaxation and electron correlation through third order in perturbation theory, will be utilized in the investigation of the energetics of ionization processes in molecules.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0021, SPACE ENVIRONMENTAL EFFECTS ON ADVANCED COMPOSITES
R.C. Tennyson, University of Toronto, *Medical Sciences Bldg., Toronto, Ontario, Canada* M5S 1A8 (DF053280; AFOSR-78-3694)

AF function - large space structures will be of major significance to the Air Force with the operational capability of the space transportation system (STS). Opportunity - the influence of the space environment on the mechanical and thermal properties of advance composite structural materials is largely unknown. This research will provide a unique opportunity to investigate these conditions. Objective - to identify the influence of simulated and in-site space environmental conditions on the mechanical characteristics of advanced composite materials in real time and to evaluate accelerated environmental exposure techniques. How work contributes - results will contribute to the development of large space structure for the Air Force.

Tubular test specimens fabricated from graphite-epoxy prepreg tapes will be used in the experimental research. Both lay-up angles for symmetric laminates and ply thickness will be varied during the experiments to be conducted. Experiments will be conducted at both ambient and simulated space conditions. Space simulated conditions will be at 10 EXP 7 TORR and from minus 200F to plus 250F. Thermal coefficients of expansion (CTE), internal stresses and outgassing products will be measured under steady state exposure and thermal cycling. In addition, stress-strain behavior, strength and fracture toughness will be determined as a function of exposure conditions. Accelerated environmental exposure techniques will also be investigated. Finally, comparisions will be made between the experimental results obtained as a result of ground-space simulation and results from specimens used on NASA long duration exposure facility (LDEF).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0022, THE DYNAMICS OF SOLID PROPELLANT COMBUSTION
L. De Luca, Politechnico di Milano, Instituto de Maccine, *Piazza Leonardo da Vince 32, Milan, Italy* (DA0D9384; DAERO 78 G0029)

Main objectives of the proposed research program are (1) to define the static and dynamic stability boundaries, and the pressure deflagration limits, (2) to investigate the existence, uniqueness and multiplicity of the equilibrium configurations, and (3) to locate the range of parameters allowing only self-sustained oscillation as regime solution.

The theoretical work will follow on the original guidelines developed by the principal investigator during the last few years. An approximate but standard integral method allows an ordinary differential equation formulation of the governing thermal diffusion problems in condensed phase with a quasi-steady gas phase. The structure of this nonlinear ordinary differential equation suggests the existence of critical points affecting both the static and dynamic stability of the propagating heterogeneous combustion wave. The experimental program is as follows: 1st year, dynamic extinction and pressure deflagration limit; 2nd year, upper, static and dynamic instability; 3rd year, self-sustained oscillations.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

3.0023, LITHIUM-BASED ANODES FOR SOLID-STATE BATTERIES
B.C. Steele, University of London, *Senate House, London, England, United Kingdom* (DF050190; AFOSR-77-3460).

AF function - a variety of communications and flight operations depend on auxiliary battery sources for power. Deficiency - lightweight, longer life, high energy density batteries are required to meet operational needs. Objective - this research involves determination of thermodynamic and transport properties of materials that could function as solid state electrolytes and anodes. How work contributes - research results should permit new superionic materials to be developed and permit understanding of ion transport mechanisms. Materials may be of use in practical battery systems employing solid electrolytes.

Transport properties and thermodynamics of selected intermetallic compounds that could operate as lithium solid solution anodes would be studied. Thin solid-state electrolyte films of lithium nitrides and lithium oxy-nitride would be prepared by several methods and properties compared. Interface processes between lithium containing anode and solid electrolytes will be examined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, INTENSITY SCINTILLATION MEASUREMENT
J.C. Dainty, Southeastern Center for Electrical Engineering Education Inc, *Auburn, Alabama* 36830 (DF921530; F30602-78-C-0148)

The objective of this effort is to measure statistical properties of the intensity of turbulence degraded images.

A dual photon-counting photometer will be used to observe images from an 84cm telescope. Electronic signal processing will be used to obtain the desired statistical parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0002, ADVANCED ANALYSIS FOR FUTURE MISSILE G&C (DA0G1160)

W.C. Kelly, U.S. Dept. of Defense, Army, Missile Research & Development Command, Guidance & Control Directorate, *Redstone Arsenal, Huntsville, Alabama* 35809 (DA0G0462)

7910-8009 - Develop analytical techniques for analysis and synthesis of future G&C systems, particularly emphasizing digital techniques. Develop preliminary mathematical models of early candidate missile configurations and guidance laws. Initiate planning of simulations for preliminary design.

7910-8009 - Adapt existing continuous-system analytical tools for use with candidate missile models. Develop new analytical tools directed toward digital autopilot analysis and design. Select low-order mathematical missile models for early candidates, based on linear system assumptions and uncontrained control. Initiate design of all-digital computer programs for assessing the guidance performance of the mathematical models using candidate guidance laws.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Guidance & Control Directorate

4.0003, LASER PHOTOCHEMICAL REACTIONS

J.A. Merritt, U.S. Dept. of Defense, Army, Missile Research & Development Command, Missile Research Directorate, *Redstone Arsenal, Huntsville, Alabama* 35809 (DA0G1064)

The objective of this task is to demonstrate the laser photochemistry synthesis of high performance propellants, burning rate stabilizers. and binder molecules for Army missile applications and other costly, difficult-to-obtain Army materials.

Using laser photochemical reaction (LPR) techniques, irradiation of reactant gases with CO2, DF and/or other laser frequencies in a cost-effective synthesis of Army materials will be investigated. For the current fiscal year, studies of new synthesis of BF3 and the grafting or radical species to various compounds will be conducted.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Missile Research Directorate

4.0004, COMMUNICATIONS - LARGE OPTICS TECHNOLOGY

R.R. Shannon, University of Arizona, Graduate School, Dept. of Optical Sciences, *Tucson, Arizona* 85721 (DN075335; N00014-80-C-0565)

The objective of this work unit is to conduct independent analyses and evaluation to support the DARPA development of large space optics. Results will impact Navy requirements for optical communications, surveillance, and weapons systems.

To accompish this objective, current techniques for surface measurement and monitoring including multi-wavelength laser interferometry, holographic interferometry, and Hartmann testing will be investigated and their performance evaluated against large optics requirements; the state-of-the-art of design and fabrication of conical and toric laser resonator optics will be reviewed and compensating optics that can be used for relatively simple on-machine measurements of such components will be designed; and design of a large active mirror concept will be completed and transient and static thermal analysis performed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0005, THE EVALUATION OF TURBULENCE MODELS BY NUMERICAL SOLUTIONS OF THE NAVIER-STOKES EQUATIONS

J. Ferziger, Nielsen Engineering & Research Inc., *510 Clyde Ave., Mountain View, California* 94043 (DN775080; N00014-77-C-0008)

The development of accurate models of turbulence is central to the formulation of reliable design methodologies for predicting viscous flow phenomena associated with aircraft, missiles and ships. The proposed research will utilize 'exact' solutions of the Navier-Stokes equations to assess commonly used turbulence closure models.

In the present research, the Navier-Stokes equations will be solved, numerically, by finite difference and spectral methods to provide numerical data with which turbulence spectral methods can be assessed and developed. Initially, calculations by finite difference and by spectral methods will be compared for the case of homogeneous isotropic flow. Subsequently the spectral method will then be used to predict homogeneous nonisotropic (mean shear and strain) flows. In addition a closure model for the viscous sub-layer flow appropriate for both Reynolds-averaged and subgrid-scale turbulence will be developed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0006, THE VALUE OF DYNAMIC FRACTURE TOUGHNESS AND ITS DEPENDENCE ON MATERIAL PROPERTIES AND LOADING CONDITIONS (14932-E)

G. Herrmann, Stanford University, School of Engineering, Dept. of Applied Mechanics, *Stanford, California* 94305 (DA0F9195; DAAG29-78-G-0086)

To develop a direct and reliable method for the evaluation of the dynamic fracture toughness coefficient during fast crack propagation. Relevance: The results of this study will be important for the analysis of high strength materials under dynamic flight conditions such as in the viper and BMD interceptors, as well as for crash resistant structures.

The problem will be modelled by a boundary value problem and solved using a two-dimensional Lagrangian, finite difference wave propagation code.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0007, PREPARATION & PROPERTIES OF A(X)Ga(1-X)As CHROMIUM SINGLE CRYSTALS

G.L. Pearson, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DN880268; N00014-78-C-0297)

This work seeks to devsemi-insulating layers of III-V semiconuctors suitable for application in MISFET structures. It further seeks to answer questions concerning the interactions and stability of chromium in gallium arsenide with aluminum substitution.

To prepare by liquid phase epitaxy single crystals of chromium doped gallium arsenide and gallium aluminum arsenide. To investigate the physical and electronic properties by various techniques including transient capacitance and photocapacitance and to apply these results towards preparing MISFET structures.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0008, SHIP HYDRODYNAMICS

M. Van Dyke, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (DN875416; N00014-78-C-0373)

A continuing and important requirement of naval operations is an increase in the speed of ships and a decrease in their motions in a seaway. This task will develop improved techniques for calculating wave-making resistance of ships, which is a necessary step in the development and evaluation of techniques to achieve the above requirement.

The techniques of regular and singular perturbation methods, series truncations and computer extension and improvement

of regular perturbation series will be applied to a variety of hydrodynamic problems.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0009, SYSTEMS ENGINEERING FOR AMRL MODELING AND SIMULATION RESEARCH PROGRAMS

E. Meyer, System Development Corp., *2500 Colorado Ave., Santa Monica, California* 90406 (DF324720; F33615-79-C-0505)

The objective is to conduct systems analysis and engineering to support the development of computer simulations of AF systems by AMRL. This workunit supports AMRL efforts to perform system simulation studies that yield engineering data to be applied to the analysis and design of near- and far-term AF systems. In order that AMRL may conduct comprehensive and effective systems simulation research programs employing the most representative simulations attainable, continual systems analytical support is required. For example, it is necessary to identify system missions and functions that may require implementation in an AMRL system simulation test bed. The product of this workunit will be a series of quantitative models of selected system elements (e.g. missions, functions, weather, threats, etc.) for implementation in AMRL system simulations.

The contractor will conduct analyses on an 'as required' basis. Each analysis to be performed will be determined based on AMRL and other principal users' program requirements. The general procedure will be to task the contractor. Each task will deal with a specific system or element of a system such as an expected jamming threat. The contractor will identify the requirements for simulating the system element under consideration. Following the identification of requirements for simulation, decisions will be reached to determine whether a simulation of the element should be implemented and if so, in what form. Criteria will relate to the importance of the element, case of simulation, current availability of quantitative models of the element, etc. If the decision is made to implement, the contractor will then develop, flow chart, and numerically quantify a model of the element for implementation into system simulation software. The contractor's responsibility on each task will end with AMRL acceptance of completed flow charts, associated quantifications, and justifying documentation of requirements and assumptions.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Human Engineering Div.

4.0010, AIR DEPLOYED FIBER OPTIC CABLE

R. Seiple, U.S. Dept. of Defense, Navy, Naval Ocean Systems Center, Environmental Sciences Dept., *San Diego, California* 92152 (DN088510)

To demonstrate the feasibility of deploying long lightweight, fiber optic communication cables at sea from low-flying aircraft.

This program has two phases. Phase I involves an analytical analysis of cable payout and external effects, with special emphasis on the problems associated with ejection of repeaters or sensors. Phase I also includes the design and test of a breadboard method of deployment, again including the repeater and sensor problems. Given the success of Phase I, Phase II will involve the design, construction and test of a 50 km system, deployed from an aircraft of opportunity.

SUPPORTED BY U.S. Dept. of Defense, Naval Electronics System Command, Research & Tech Directorate

4.0011, FABRICATION OF MULTILAYER HETEROSTRUCTURES

N. Bottka, U.S. Dept. of Defense, Navy, Naval Weapons Center, *China Lake, California* 93555 (DN082481)

The objective of this program is to fabricate multi-layered GaAs1-XSBX heterostructures and to investigate these structures under very high electric field conditions. Electro-optic phenomena such as electroreflectance at or near avalanche conditions will be studied. Concepts such as the multi-color ac spectrum analyzer will be investigated.

We intend to grow by the liquid phase (LPE) multilayer GaAs1-XSBX structures in the composition range x equals 0.03 to 0.10. Subsequently we will use photolithographic techniques to delineate 1-4 mm2 active areas, electroplate thin pt Schottky barriers onto them, mask them off, and irradiate the perimeters with energetic protons. This will form guard rings and will prevent premature edge breakdown. After sputtering ohmic contacts on the GaAs substrate side of the structure we will mount the sample and attach Au leads to the electrodes. Basic I-V and C-V measurements will be performed to determine the breakdown voltage and the carrier concentration in the top-most layer. We will make electroreflectance (ER) measurements by superimposing an ac modulation on top of the dc bias. We will measure ER at various critical points as a function of applied dc field. We should observe interesting 'spill over' phenomena in the ER spectrum for higher transitions near avalanche conditions. Aside from these fundamental studies, we will fabricate very thin multilayer structures (1 micrometer or less). By applying a reverse bias to such structures, we should be able to observe multi 'reach-through' phenomenon, i.e., we will try to deplete across successive layers by applying large reverse bias. By superimposing an ac modulating voltage on the dc bias and by shining polychromatic light through this structure, we should observe light modulation at discrete wavelengths corresponding to the successive modulation of the individual absorption edges of the layers. These measurements will help in designing a prototype ac spectrum analyzer.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0012, FREE SHEAR TURBULENCE INVOLVING MEASUREMENTS OF PASSIVE SCALARS AND PRESSURE FLUCTUATIONS.

P.A. Libby, University of California, San Diego Campus, School of Engineering, Dept. of Applied Mechanics & Engineering Science, *P.O. Box 109, La Jolla, California* 92037 (ENG78-15712)

This study deals with the detailed flow structure of the wake of a heated cylinder and the measurement of associated space and time-resolved static pressure fluctuations. Of concern are the three-dimensionality of the turbulent structures in the constant pressure gradient on the turbulent wake. The methods of conditioned sampling are employed and a pressure probe permitting correction of the apparent static pressure for contamination due to transverse velocity fluctuations is developed.

This grant continues work carried out under NSF Grant ENG 76-09271.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0013, UNSTEADY FLOW OF AN OSCILLATING AIRFOIL IN TRANSLATIONAL MOTION (14741-E)

C.M. Ho, University of Southern California, School of Engineering, Dept. of Aerospace Engineering, *3551 University Ave., Los Angeles, California* 90007 (DA0F9137; DAAG29-78-G-0023)

To investigate the unsteady velocity and pressure fields about an oscillating airfoil in translational motion normal to the freestream, in order to study the unsteady leading edge separation and the unsteady Kutta condition. Relevance: The description of the unsteady flow environment of a plunging airfoil is to direct relevance to understanding and predicting helicopter retreating blade stall and stall flutter, the delimiters of helicopter performance in forward motion.

The velocity and pressure fields of a heaving airfoil using novel measuring (hot-wire anemometry) and data processing techniques (mini-computer) will be determined for a range of Reynolds numbers and reduced frequency of oscillation. Details of leading edge vortex bursting, subsequent viscous-inviscid flow interaction and unsteady flow about the sharp trailing edge will be quantitatively determined.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0014, A GALERKIN-FINITE ELEMENT TECHNIQUE FOR SMALL-SCALE ATMOSPHERIC FLOWS AND TRANSPORT OVER GENERAL TERRAIN (15810-GS)
R.L. Sani, University of Colorado, Boulder Campus, School of Engineering & Applied Science, Dept. of Aerospace Engineering Sciences, *1200 University Ave., Boulder, Colorado* 80302 (DA0G8967; DAAG29-79-G-0045)

To develop and assess a primitive variable, Galerkin-finite element (GFE) technique which can accomodate general topography and which leads to a discretized system involving only velocity model unknowns. Relevance: Many battlefield problems involve understanding of air flows in complex terrain. This is basic research which has long-range relevance to better modeling of air flows based on observations at a few sites.

The approach involves exploring theoretically and numerically the possiblities that GFE techniques are appropriate for application to small-scale flows where irregular terrain is a problem.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0015, AN EXPERIMENTAL AND ANALYTICAL STUDY OF BOUNDARY LAYERS IN HIGHLY TURBULENT FREE-STREAMS
R.P. Dring, United Technologies Corp., Research Laboratories, *400 Main St., East Hartford, Connecticut* 06108 (DF052270; F49620-78-C-0064)

AF function - advanced turbomachinery. Opportunity - improvement of present methods for predicting heat transfer and aerodynamics losses on cooled gas turbine blades. Objective - determine the influence of free-stream turbulence level on the heat transfer and profile development of 1) two dimensional, fully turbulent, zero pressure gradient boundary layers and 2) two dimensional, accelerating transitional boundary layers. How work contributes - will provide data to modify current turbine airfoil aerodynamic and cooling design systems so they will more accurately account for the entrainment of free stream turbulence energy into boundary layers and for the combined effects of acceleration and free stream turbulence on the boundary layer transition process.

An experimental program will be performed and data obtained for fully documented boundary layer flow for various turbulence levels and free stream velocities. Following this similar data will be obtained for transitional boundary layer flow. The data obtained will then be compared to the predictions obtained from the UTRC finite-difference boundary layer calculation method.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0016, VIS/IR SOLID STATE LASERS
L. Esterowitz, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680220)

Investigate VIS/near IR lasing transistions from trivalent rare earth ions in crystalline host lattices.

Transitions with high oscillator strengths in the VIS/near IR region will be studied in solid crystalline materials. Crystal samples will be supplied by MIT and AIRTRON.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0017, SATELLITE AND NAVIGATION TECHNIQUES
S.H. Knowles, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880101)

Investigate applications of radio astronomy techniques to oceanography and navigation systems. Develop new satellite applications using radio and infrared techniques for navigation, surveillance and atmospheric investigations.

Develop concepts for application of radio astronomy techniq es, especially interferometry, for improved navigation and oceanography. Develop satellite interferometer techniques and investigate uses of radio link satellites for above purposes. Develop concepts for submillimeter satellite use for surveillance, and atmospheric and astronomical investigations. Study extension of radio interferometer concepts to other wavelength ranges.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0018, AUTONOMOUS SATELLITE SENSOR PROGRAM
F.L. Markley, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980065)

The purpose of this effort is to study the accuracy of determination of a spacecraft's attitude and ephemeris by autonomous navigation methods utilizing combinations of star sensors, landmark recognition systems, and inertial reference units and to study the influence of spacecraft nonrigidity on the accuracy attainable.

The study will utilize an error covariance analysis based on optimal estimation techniques and containing models of the spacecraft dynamics (linearized), various sensor configurations, and expected distributions of stars and landmarks. The study will analyze both the absolute accuracy of the spacecraft attitude and ephemeris determination as well as the accuracy with which the location of objects on the Earth's surface relative to the landmarks can be established.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0019, SHOCK TESTING OF OPTIC INSERTS FOR PRESSURE VESSEL
R.L. Phillips, State University System of Florida, University of Central Florida, School of Engineering, Dept. of Electrical Engineering & Communication Sciences, *P.O. Box 25000, Orlando, Florida* 32816 (DN080277; N61339-79-C-0105)

To develop a shock tube and associated test procedures for shock testing fiber-optic pressure wall feed-through plugs. To test fiber-optic plugs under development by NRL for survivability and for changes in optical transmission characteristics.

A previously developed conical water shock tube will be evaluated and modified as required to produce shock waves with peak pressures of 15 KPSI and rise times less than 0.5 MS. The mechanical and acoustical properties of the tube will be analyzed as part of the evaluation. The required tests will then be performed using the modified shock tube.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0020, TEST CELL FILTER STUDY
D. Lundgren, State University System of Florida, University of Florida, School of Engineering, Dept. of Environmental Engineering, *220 Black Hall, Gainesville, Florida* 32611 (DF336920; F08637-79-M-0084)

The US Air Force has been cited for violation of state opacity standards for its jet engine test cells. The objective of this project is to investigate the filter loading characteristics of glass fiber filters for opacity reduction in test cells which would be more cost effective than existing methods.

This contractual effort will provide data for four glass filters and various combinations of the filters. The data will be measurements of filter loading characteristics for a simulated jet engine test cell aerosol. The data will be used to recommend the optimum filter media combination. Economic and physical feasibility will be discussed.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

4.0021, FAILURE OF METAL MECHANICAL JOINTS UNDER BLAST LOADS
C.A. Ross, State University System of Florida, University of Florida, School of Engineering, Dept. of Engineering Science, *220 Black Hall, Gainesville, Florida* 32611 (DF045850; AFOSR-76-3157)

AF function - to add needed knowledge in the area of aerospace vehicles, propulsion systems and weaponry. The failure of structural elements because of damage by dynamic blast loads in phenomenologically complex and improved modeling methods are badly needed. Deficiency - in aerospace applications, the boundaries of many structural elements are bolted or riveted joints. As such, these joints are not to be traditionally modeled as fixed, simply supported or free conditions. In addition, computer modeling of these complexities has proven to be cost prohibitive. Therefore, a deficiency exists and work must be done to overcome same. Objective - this research will use energy methods as a prerequisite study procedure for analytical modeling of joint degradation from blast loads. Through the use of energy methods and analytical modeling, a better understanding of mechanical joints should evolve. How work contributes - additional scientific information about joints will serve to improve aerospace vehicles, propulsion systems and weaponry devices. In this way, better Air Force systems will be the long-range result.

The primary emphasis of the analytical research effort will be to formulate the proper foundation for fracture mechanics applications under biaxial applied loads. The experimental portion will emphasize the determination of the effects of biaxial applied loads on the fracture toughness and on fatigue crack growth rates.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0022, NAVY ENVIRONMENT - LIGHTNING STATISTICS

M.A. Uman, State University System of Florida, University of Florida, School of Engineering, Dept. of Electrical Engineering, *220 Black Hall, Gainesville, Florida* 32611 (DN723204; N00014-75-C-0143)

The objective of this research will be to extract from the considerable mass of data accumulated under the Thunderstorm Research International Program (TRIP) certain statistical properties of lightning including the distinguishing characteristics of over-land and over-water lightning, strokes/flash, electric and magnetic field strengths, peak currents and movement. Military application of the research would be to improvement of lightning location and warning systems.

Numerous investigators pooled their observing capabilities at Cape Kennedy under the TRIP to obtain a considerable amount of data on thunderstorms and lightning. The contractor will select from this data that is most suitable and subject it to analysis to determine various lightning characteristics.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0023, DERIVATION AND COMPARISON OF OPTIMAL FILTERS II

M.E. Warren, State University System of Florida, University of Florida, School of Engineering, Dept. of Electrical Engineering, *220 Black Hall, Gainesville, Florida* 32611 (DF642750; F08635-78-C-0179)

Air Force function - development of advanced guidance algorithms for tactical air-to-air missiles. Deficiency or opportunity - to increase percent kill of highly maneuvering target aircraft. Objective - the objective of the effort is develop and compare various estimation techniques that have potential application to short range air-to-air missiles. Various estimation techniques will be developed to obtain the required states/parameters for implementing the types of guidance laws derived under previous contract efforts.

The approach for this effort will be for the contractor to determine the various states/parameters required to implement the guidance laws derived under previous contractual efforts. The contractor will analytically assess the feasibility of applying various estimation techniques for estimating the necessary states/parameters. These estimation techniques will include splines, polynomial estimation, function estimation, and adaptive filtering. The contractor will fully develop the most promising techniques and evaluate the derived estimation algorithms using a complete non-linear 6-DOF simulation with a generic missile model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

4.0024, HEAD AND EYE TRACKING SYSTEM

D. Breglia, U.S. Dept. of Defense, Navy, Naval Training Equipment Center, Advanced. Simulation Concepts Lab., *Orlando, Florida* 32813 (DN994012)

In eye-coupled area of interest display systems, head/eye tracking subsystems essential. Research is required to determine the maximum allowable delay in presentation of visual scenes after head and eye movements. Research on eye movements in horizontal, vertical and slant modes is needed to determine the feasibility of predicting final eye fixation points from data early on in the movements.

A television system will be used to produce a spot which will follow the head and eyes as they move to various positions. Variable delays ranging from 4 to 154 milliseconds will be introduced betwen head/eye motion and the motion of the spot on the TV screen. The maximum allowable delay will be determined using standard human factors testing techniques. An electronic system will be built and used to determine angular eye velocities. A determination will be made as to whether or not final eye fixation points can be predicted from velocity curves (e.g., From maximum eye velocity vs. final eye position.)

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Advanced Simulation Concepts Lab.

4.0025, SPECIALIZED RESEARCH EQUIPMENT - ACQUISITION OF LASER DOPPLER VELOCIMETRY SYSTEM FOR COMBUSTION RESEARCH

A.C. Fernandez Pello, Northwestern University, Evanston Campus, Technological Inst., Dept. of Mechanical Engineering, *633 Clark St., Evanston, Illinois* 60201 (CPE80-15568)

Funds are provided for the acquisition of a Laser Doppler Velocimetry System to be used in combustion research programs in the areas of 1) direct pyrolysis and resonant combustion of coal and synthetic fuels, 2) fundamental mechanisms of flame propagation over solid combustibles, 3) fundamental flame structure studies, and 4) spray combustion of multiphase, multicomponent fuels.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Chemical & Process Engineering

4.0026, FLUID DYNAMIC MECHANISMS AND INTERACTIONS WITHIN SEPARATED FLOWS AND THEIR EFFECTS ON MISSILE AERODYNAMICS (16719-E)

A.L. Addy, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Mechanical & Industrial Engineering, *106 Engineering Hall, Urbana, Illinois* 61801 (DA0G9177; DAAG29-79-C-0184)

To perform an investigation of the fundamental fluid dynamic mechanisms and interactions within the separated flow regions characteristic of base flows and the interaction between base and body flows including small angles of attack and their effects on missile aerodynamics. Relevance: The research is directly relevant to establishing advanced technology for the design and development of advanced missiles/rockets and gun launched projectiles. The investigation will have significant impact on presently active research investigations at both MIRADCOM and BRL.

Theoretical analyses based on component and interactive component modeling using integral and finite-difference techniques are planned. The experimental investigation will include in-house small-scale experiments of fundamental mechanisms and analysis of results from large-scale experiments conducted in cooperation with other research groups.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0027, PROPERTIES OF THIN FILM SEMICONDUCTOR STRUCTURES

B.G. Streetman, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *106 Engineering Hall, Urbana, Illinois* 61801 (DN675519; N00014-76-C-0806)

Future Navy electronics systems will use solid-state electronic components fabricated from compound semiconductor materials. New fabrication techniques and new device structures need to be evaluated along with characterization of the properties of the materials.

The investigators will study various properties of materials and device structures fabricated from various III-V semiconductors. Effects of ion implantation will be investigated through photoluminescence and transient capacitance techniques comparing results on variously grown materials. The effects of various annealing techniques will be correlated with optical and electrical response. High field transport studies, both experimental and theoretical will focus on several questions, including, effects of defects on low and high mobility in ion implanted materials, orientational dependence on impact ionization coefficients, and effects of heterojunction boundaries. Heterojunction properties will be correlated with growth techniques and parameters, with particular emphasis on lattice mismatch effects.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0028, IMPACT OF MICROPROCESSORS ON EMC

B.J. Leon, Purdue University, Purdue Research Foundation, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (DF737870; F30602-75-C-0082)

The objective of this effort is to allocate money to Purdue University under the RADC post-doctoral program. This effort is to determine the impact of the increasing use of microprocessor/microcomputers on the electromagnetic compatability of Air Force systems. Topics of concern are assessment of the state-of-the-art of microprocessors/microcomputers vis-a-vis Air Force requirements, survey of present and future Air Force usage, assessment of the potential of microprocessors/microcomputers as an aid in EMC control (i.e., preprogrammed filter tuning, frequency management devices, etc.), develop recommendations for research efforts which would provide system designers with the information required to account for the emc impact of microprocessors/microcomputers (microsystems) in Air Force systems.

This effort will develop general knowledge regarding the optimum electrical test conditions for 16K dynamic RAMS, and provide criteria for specifying critical electrical parameters for use in government-prepared MIL-M-38510 specifications. This will include a detailed static, dynamic, and functional analysis of 16K dynamic RAMS. Important features, limitations, and interchangeability criteria will be determined and compared according to established tradeoffs such as powerspeed, temperature-frequency, etc. In addition, special test methods for characterizing microprocessors will be developed and reported in a format compatable for use in MIL-STD-883.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0029, RADAR - FREE FIELD MEASUREMENT OF TRANSIENT SURFACE CURRENTS ON SCALE MODEL STRUCTURES

L.W. Pearson, University of Kentucky, School of Engineering, Dept. of Electrical Engineering, *Limestone & Euclid, Lexington, Kentucky* 40506 (DN775384; N00014-77-C-0362)

Methods for extracting the complex natural resonances or singularity expansion method (SEM) description of objects through direct measurement of surface currents are investigated to lay the basis for realtime noncooperative target classification, discrimination, or passive IFF by naval radars. The methods are also applicable to the determination of electromagnetic vulnerability of military platforms and systems to nuclear electromagnetic pulse (EMP).

The research involves the development of test configuration and strategies for free-field transient SEM extraction from experimental measurements of surface currents taken with subminiature probes.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0030, MULTIVARIABLE STABILITY MARGINS FOR VEHICLE CONTROL SYSTEMS

N.R. Sandell, Alphatech Inc., *Burlington, Massachusetts* 01803 (DN075481; N00014-80-C-0509)

New aircraft designs for the fighter and V/STOL missions will incorporate multi-input/multi-output control systems as well as state observers or Kalman filters. The military specifications and design techniques for this class of control systems are inadequate to assure that acceptable gain and phase margins are provided. The objective of this program is to conduct research in developing practically useful stability margin definitions for multivariable feedback systems.

The approach will be to examine recent theoretical advances in the robustness theory of multivariable systems including techniques based on singular value analysis, norm plots, sector stability conditions, inverse Nyquist arrays, and characteristic loci. Graphical techniques for each of these methods will be developed and compared for ease of use and conservativeness. Candidate stability margin definitions will be evaluated for specific vehicle control laws.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0031, HELMET MOUNTED OCULOMETER DEVELOPMENT

J. Merchant, Honeywell Inc., Radiation Center, *2 Forbes Rd., Lexington, Massachusetts* 02173 (DF142950; F33615-77-C-2077)

The mission this work unit supports is the simulation of advanced aerospace vehicles. The engineering flight simulator is a modern tool for the analysis and evaluation of current and future Air Force systems. The opportunity exists with simulations to develop proposed flight control system schemes including cockpit controls and displays. This requires man-in-the-loop participation throughout the design evaluation. The objective of this work unit is to develop, install, demonstrate and maintain a system capable of both head and eye measurements of the test subject without any attachments to the subject and within the framework of moving base simulation. This program contributes to effective simulation of flight vehicles.

Studies will be conducted to establish the optimum location for equipment to be installed. The equipment will then be engineered to be compatible with installation requirements. All power and signal cables will be installed and the equipment will be installed and demonstrated. The demonstration will consist of 3 hours of reliable data acquisition daily for a period of two weeks with no more than 30 minutes downtime per eight-hour shifts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0032, STUDIES RELEVANT TO THE INTERACTION OF SPACECRAFT WITH PLASMA

J.W. Cipolla, Northeastern University, School of Engineering, Dept. of Mechanical Engineering, *360 Huntington Ave., Boston, Massachusetts* 02115 (DF053690; AFOSR-78-3731)

AF function - AF communication and surveillance satellites have been affected deleteriously by interaction with energetic charged particles in the space environment. Environmentally induced arc-discharges can cause loss of satellite command and telemetry communications and disrupt entire missions. Deficiency - anomalous behavior can occur in synchronous orbit satellites and satellites in lower orbits. The charging of the spacecraft by energetic electrons in the magnetosphere can produce large negative differential potentials and damaging discharges. Objective - develop a mathematical model of the time dependent spacecraft-plasma interaction, and study low frequency instabilities and shock wave structure which can generate energetic electron clouds in the geosynchronous plasma in excess of those associated with magnetospheric substorms. Contribution - provide a more complete understanding of the plasma environment at geo-

synchronous orbit and of the dynamic interaction of solid bodies and space plasmas.

This research will be directed to an understanding of the plasma environment at geosynchronous orbit and the dynamic interaction of solid bodies with such plasma. A model describing beam-whistler and ion-cyclotron instabilities for the generation of precursor turbulence in shock waves propagating along the magnetic field will be studied to include the distribution function of ions reflected from the electrostatic subshock potential barrier and the effects of oblique propagation on parallel shock wake structure. In particular, the density of the reflected ions and the ion density and turbulent magnetic field profiles in the vicinity of the leading edge of the shock wave will be calculated. A planar mathematical model of the time dependent spacecraft-plasma interaction will be studied and modified to include realistic geometries, sudden surface charge deposition, charged particle emission due to photo-emission or charged particle beams, and dielectric components on the conducting surface to allow differential charging.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0033, HIGH RELIABIILTY TECHNIQUES FOR MICROWAVE POWER FETS

R.W. Bierig, Raytheon Co., Research Division, *28 Seyon St., Waltham, Massachusetts* 02154 (DN875610; N00014-78-C-0622)

This work seeks new approaches to improving the reliabiilty of microwave power field effect transistors for various Navy electromagnetic applications.

Common refractory metallization techniques will be investigated in such a manner that alloying of the ohmic contacts is not a required step in device fabrication. Ohmic contacts shall be tunnel junctions of platinum and/or titanium and tungsten, on laser annealled highly doped (e.g., 10 (19) per cubic cm) source and drain contacts. D.C. and RF life testing will be accomplished. Various surface passivation techniques will be employed and careful attention to the buffer/active interface will be maintained.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0034, LASER DIAGNOSTICS OF METALLIC PLASMA

D.R. Bach, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Nuclear Engineering, *Ann Arbor, Michigan* 48104 (DF039640; AFOSR-79-0030)

AF function - operation of high altitude vehicles in a post nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand advanced equipment unavailable to date. Deficiency - present day information is inadequate to design the aforementioned equipment. Such information may be obtained from experimental and theoretical work in metallic (collisional) plasmas. Objective - this project will investigate experimentally various diagnostic methods on high density metallic plasmas. Exploding wire plasmas (in particular, aluminum) will be investigated. Contribution - this work is a part of a comprehensive program on plasma research for the development of an X-ray radiation source for simulations of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and ion beam), the development of space and ionospheric communications and the development of countermeasures.

The proposed work includes the improvement and optimization of the present X-ray pinhole photography techniques used to determine the geometrical shape of the X-ray emitting regions of the exploding wires. In addition, there will be a study of the aluminum exploded wire dynamics during the first 2 micro sec, the design and construction of a spectrometer for measuring wavelength dependent X-ray line radiation from the plasma, interpretation of the line ratios to determine plasma temperature (in cooperation with numerical calculations conducted by University of Michigan Profs. Ong and Duderstadt under AFOSR grant 76-2904), the use of a microchannel plate for X-ray imaging, and a study of the change in X-ray radiation from the plasma induced by a radially incident high intensity CO2 laser pulse.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0035, STUDIES IN VECTORIZED SPARSE ELIMINATION

D.A. Calahan, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Electrical & Computer Engineering, *Ann Arbor, Michigan* 48104 (DF058380; AFOSR-80-0158)

AF function - design of aerospace vehicles - study of nuclear weapons effects on strucutres and aerospace vehicles. Opportunity - to uncover new numerical methods for greatly improving the computational speeds (currently too slow for realistic studies) in computer simulations of many large engineering systems. Objective - to investigate novel numerical methods for solving directly large systems of equations on large scale vector computers. How work contributes -large systems of equations arise routinely in computational studies involving aerodynamics, structural analysis, electronic circuits, etc. And the solution of these large systems often require most of the execution time in the study. Clever algorithms could dramatically improve computational time and lead to more accurate simulation studies.

Review spall data from previous He and Ne experiments to determine extent and duration of spall, initial conditions and ground motion characteristics before, during and after spall. Attempt to identify spall causing mechanisms. Analyze relationships between spall parameters and independent variables such as weapon yield, height of burst, depth of burst, and material properties.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0036, COMMAND AND CONTROL - COLOR DISPLAY DESIGN GUIDE

M.M. Krebs, Honeywell Inc., Systems & Research Center, *2600 Ridgeway Pkwy. N.E., Minneapolis, Minnesota* 55413 (DN675169; N00014-78-M-0072)

The objective of the research is to develop a design guide, a set of principles for the design of aircraft displays which would incorporate the use of color. The integration of cockpit displays has created displays cluttered with information which increases pilot/operator workload. Color offers an additional dimension to information coding which appears to offer improved display information transfer. Color engineering technology is available for displays. However, the optimum application of color to the information to be displayed has not been established.

The technical approach will be based on a laboratory research program which will supplement available color research data. Additional inputs to the research data will be provided through working group sessions involving contractor and government representatives. The contractor will assimilate the research data, formulate a design guide, and make color coding recommendations for specific displays.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0037, CURVATURE EFFECTS ON EFFECTIVENESS AND HEAT TRANSFER IN THREE-DIMENSIONAL FILM COOLINGS (16595-E)

E.R. Eckert, University of Minnesota, St. Paul Campus, Inst. of Technology, Dept. of Mechanical Engineering, *St. Paul, Minnesota* 55114 (DA0G9098; DAAG29-79-C-0117)

To conduct an experimental and analytical fundamental study to determine the influence of curvature for the design of film cooling arrangement of turbine blades. The curvature of the turbine blades will affect the heat transfer coefficient and will be used to predict the blade temperatures and, consequently, the ensuing blade thermal stresses. Relevance: This work is applicable to Army helicopter engines where the current trend is to higher temperature, highly cooled gas turbines.

The heat transfer of flow around a circular cylinder, with coolant injection through a row of holes, will be measured in a

low speed wind tunnel. The pressure variation along the cylinder surface, as well as the boundary layer development without and with film cooling, will be obtained. The mass transfer analogy will be used to determine the film cooling effectiveness. Foreign gas will be ejected through the holes and the condensation of this gas along the cylinder surface downstream of the holes will be measured using a gas chromatograph. A second cylinder covered by a thin layer of napthalene will likewise be tested.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0038, ROCKET EXHAUST PLUME MODEL STANDARDIZATION

H. Pergament, Aeronautical Research Associates of Princeton Inc., *50 Washington Rd., Princeton, New Jersey* 08540 (DA0G1055; DAAK40 78 C 0124)

The objective of this work unit is to utilize the existing technology base to produce a standardized code for use by the tri-service/NASA community which models the low altitude gas dynamic flow field structure of a plume exiting a vehicle in flight.

A mathematic model and computer code will be developed which will physically describe the low altitude gas dynamic plume flow field from a rocket powered vehicle in flight. This requires modeling an external flow field in the Mach number range from static through subsonic to supersonic. The approach to accomplish this will take advantage of technological developments in this area over the past five (5) years. This effort will be a code standardization rather than a code development.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Systems Simulation & Development Directorate

4.0039, SPUTTERED MERCURY-CADMIUM TELLURIDE MATERIAL FOR INFRARED DETECTORS

R.H. Cornely, New Jersey Inst. of Technology, School of Engineering, Dept. of Electrical Engineering, *323 High St., Newark, New Jersey* 07102 (DF047800; AFOSR-77-3249)

AF function - aerospace communications, surveillance and detection systems require electro-optical devices which exploit the special properties and interactions of infrared radiation with solid state materials. Opportunity - materials sensitive in the far infrared region of the electromagnetic spectrum have a high impact for airborne and satellite applications. Objective - the aim of this research is to deposit and examine single crystals of HgCdTe by radio-frequency, triod-sputtering techniques, and to establish the dependence of material parameters such as band gap, carrier concentration and mobility, chemical composition and film stoichiometry upon deposition parameters such as Hg sputtering gas pressure, film deposition rate, and substrate material, temperature, RF bias and presputtering surface treatment. How work contributes - sophisticated electro-optical techniques in narrow bandgap compound semiconductors offer promise for electro-optical microcircuitry and for wide-angled infrared sensing in the 3-5, 8-14, and 18-25 micrometer spectral regions.

The deposition of single crystal, stoichiometric films of HgCdTe material involves radio-frequency (RF) triode-sputtering in a reactive mercury vapor atmosphere. Obtain a detailed understanding of the conductive, optical and compositional properties of sputtered HgCdTe films by measuring hall-effect and optical transmissivity and by utilizing Auger spectroscopy, electron and X-ray diffraction methods, and chemical analysis techniques. Explore the methods of forming P and N-type regions, by Hg vapor changes or simultaneous sputtering of dopants. Study trapping and noise phenomena in sputtered films using field-effect measurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0040, MICROWAVE SELF-MIXING SENSOR SIGNAL PROCESSOR II

D. Hampel, RCA Corp., *Front & Cooper Sts., Bldg. 202-2, Camden, New Jersey* 08102 (DF646770; F08635-79-C-0139)

(1) Air Force function - air-to-air missiles; (2) deficiency or opportunity - effective warhead burst point control in a small size, low cost fuze; (3) objective - develop a compact, low cost module which will analyze signals from a Doppler sensor to determine target characteristics and point of closest approach. When combined with the microwave self-mixing sensor (MSMS), a low cost, highly sophisticated air-to-air missile fuze will be realized; and (4) how work contributes -the device will increase the effectiveness of air-to-air missiles by providing optimum warhead burst point control.

Through analysis of Doppler signatures taken from numerous encounters with models and actual aircraft, an algorithm will be developed. Both hardware, CHIRP-Z, and software, fast Fourier, transform methods will be considered. Through analysis of the resulting frequency domain signals, the algorithm will determine the size of the target, and the encounter kinematics, and will produce a firing signal at the optimum time. The effect of electromagnetic countermeasures will be considered. A brassboard signal processor implementing this algorithm will be designed, fabricated and tested.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

4.0041, ANALYSIS OF GAS TURBINE ENGINE EXHAUST EMISSION VARIABILITY

A.F. Klarman, U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center, *1440 Pkwy. Ave., Trenton, New Jersey* 08628 (DN796898)

Determine the variation of engine exhaust emission levels within engine models, with increased engine operating time, with the introduction of smokeless combustors, and with respect to test cell operational variables. Estimate the number of engines required for a statistically reliable sample.

Measure emissions from a number of gas turbine engines of the same model and type before and after overhaul, and with and without smokeless combustors. Test one engine four times and measure test cell operational variables. One model of a turbojet, turbofan and afterburning engine will be tested.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

4.0042, INDUSTRY-UNIVERSITY COOPERATIVE RESEARCH (IUCR) - DATA NETWORKS AND SATELLITE COMMUNICATIONS

M. Schwartz, Columbia University, School of Engineering, Dept. of Electrical Engineering, *351 Engineering Ter., New York, New York* 10027 (ECS79-25092)

A collaborative research program involving Columbia University and the IBM Corporation on two key areas in large scale computer communication networks is being pursued. New problems generated by dynamically-changing, distributed computer networks, and data communications via satellite are being studied. Topological design, routing and flow control, and directory design are considered in the former to implement a distributed directory for dynamically-changing networks. In data communications via satellite, multiple access protocols in a multibeam, multimode, on-board processing environment are under investigation.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Electrical Computer & Systems Engineering

4.0043, TURBULENCE MODELING IN REACTIVE MIXING FLOWS

J.L. Lumley, Cornell University, Ithaca Campus, Sibley School of Aerospace & Mechanical Engineering, *Ithaca, New York* 14850 (DN975461; N00014-79-C-0482)

The objective of this study is to develop an improved modeling and measurement capability for turbulent mixing of reactive and non-reactive flows and for combustion. This information is needed for improved prediction of both the complex mixing and combustion processes within the combustors of aircraft turbojet engines and the boundary layer flow over turbine

blades with coolant injection. Ultimately it should lead to improved propulsion systems for naval weaponry applications.

Turbulence models are being developed for a two-scalar system involving homogeneous slow chemical reactions which are not pre-mixed, and for scalar transport at an interface. The work on reacting flows is based on a small perturbation around the unreacted turbulent state, while the transport work involves a similar perturbation for weak inhomogeneities. The technique is being applied to specific simple flows for which experimental data are available elsewhere. A study will be made on the fundamental flow-related limitations of non-intrusive diagnostics for flow conditions and geometries typical of turbojet engines. Emphasis will be on measurement of velocity and temperature via single port access.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0044, COMPARISON OF RAMAN SCATTERING METHODS FOR COMBUSTION DYNAMICS MEASUREMENTS

M. Lapp, General Electric Co., *1 River Rd., Schenectady, New York* 12305 (DF048790; F49620-77-C-0094)

AF function - advanced diagnostic techniques, advanced air-breathing engines, weapon delivery and defense. Deficiency - inability to obtain reliable measurement of important parameters in turbulent reacting flows in practical hostile combustion environment via present day measuring and diagnostic techniques, inability to reliably evaluate combustion models. Objective - to develop more sensitive selective, precise, reliable and rapid diagnostic methods for measuring important parameters in jet engine reacting flow environment. To determine feasibility of using vibrational Raman scattering (VRS) for obtaining high spacial and time resolution temperature measurements in practical combustion environments, to determine capabilities and limitations of VRS as a laboratory diagnostic tool, to provide reliable experimental data to the combustion modeler. How work contributes - will provide additional understanding and reliable data to permit realistic evaluation of analytic models of complex reacting flow, will help reduce development time and cost of air-breathing propulsion systems, will permit evaluation of capabilities and limitations of various diagnostic methods, will aid in development of improved or novel new in situ nondisturbing techniques for accurately measuring turbulent reacting flow parameters.

Burners applicable and appropriate for comparative study of optical diagnostics will be investigated. Several types of portable and well-characterized laboratory combustion burner facilities designed to provide laminar premixed, turbulent diffusion, and spray combustion flames will be selected and constructed. These burners will be utilized in experiments to determine a basic flame gas property (specifically, instantaneous values of temperature) by VRS in these systems. Data obtained will be compared with similar work performed in another laboratory on essentially identical combustion apparatus, using the CARS technique, (e.g., AFATL). Measurement difficulties will be purposely inserted into the probed flame systems in a controlled fashion in order to explore the significant differences between these measurement methods. The advantages and disadvantages of each technique for the various types of combustion systems encountered in air-breathing engines will be determined and their respective zones of applicability defined. Specific emphasis will be on determination of the capabilities and limitations of the VRS. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0045, LASER RESEARCH OF MOLECULAR DYNAMICS (17266-P)

P.P. Sorokin, International Business Machines Corp., *P.O. Box 218, Yorktown Heights, New York* 10598 (DA0G3466; DAAG29-80-C-0131)

Time resolved infrared spectral photography through the use of frequency upconversion. Relevance: The spectroscopic technique under development would enhance our ability to obtain information about laser induced reactions, explosive reactions and remote sensing of the atmosphere.

Improve the upconversion techniques developed previously to (a) monitor isomerization of CH3NC, (b) monitor thermal explosion of HN3, (c) obtain IR spectra of free radicals such as CH3, (d) increase the temporal resolution to the picosecond domain.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0046, RADAR BEACON DATA LINK

J. Monson, Syracuse Research Corp., *Merrill Ln., Univ. Heights, Syracuse, New York* 13210 (DN890169; N00019-79-C-0242)

Establish radar beacon data link capability for Marine Corps forward air controllers (FACS).

Modify PPN-18 FAC radar beacon to allow for manual insertion of range/bearing to target and altitude difference between target and FAC, and to provide automatic encoding of beacon replies to strike aircraft radar interrogations, design decoder/display for A-6E cockpit.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0047, OPERATIONAL R&M EXPERIENCE DATA AF ELECTRONIC SYSTEMS

E. Fiorentino, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF707570)

This in-house study will be concerned with collection and analysis of field R&M data to determine field R&M and to compare prediction and demonstration results against field R&M characteristics. Evaluation of field R&M data sources to develop improved data feedback from the field will also be an objective.

Collection and analysis of field R&M data for currently fielded electronic equipment will be performed. Air Force field maintenance and status reporting data systems (AFM 66-1) (AFM 65-110) will be used as data sources. Studies comparing predicted, demonstrated and field R&M characteristics will be performed. Limitations of Air Force data systems for performing field R&M assessments will be identified and recommendations for improvement developed. Presentation and coordination of study findings with AFLC and other AF OPR's will be done to facilitate implementing study recommendation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0048, SWITCHABLE RF INTRUDER TRACKING STUDY

R.V. Kotcherlakota, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF905630)

The objective of this effort is to conduct in-house experimental and theoretical investigations which involve the design of an electronically switchable radio frequency intruder tracking system. Present Air Force RF intrusion tracking systems lack the ability to track the intrusion in all environments and when feasible are lossy and require line amplifiers.

This study will take into account the available shuttle orbits and experimental equipment space on the Space Shuttle. Various experimental configurations are envisaged--transmitting from or receiving on the Shuttle, with the other end of the link on the ground, free-flying transponders or transmitters, released from and subsequently recovered by the Shuttle, etc. The study will identify the technical considerations appropriate to each of the major options and perform cost trade-offs between them. Specifically the study will be concerned with (1) interference to and from other experiments on the Shuttle, or Shuttle sub-systems (such as communications transmitters and receivers) and (2) the proper timing and coordination of equipment construction testing, installation and integration by NASA contractor. The study will identify, by type and/or specification, the major items of equipment necessary to perform the experiment.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0049, IMPACT INITIATED DAMAGE IN LAMINATED COMPOSITES

A.V. Sharma, University of North Carolina, North Carolina Agricultural & Technical State University, School of Engineering, Dept. of Mechanical Engineering, *N. Dudley St., Greensboro, North Carolina* 27411 (DF057160; F49620-80-C-0050)

AF function - high-performance composites will be employed as structural load-carrying components in advanced tactical and strategic aircraft. Deficiency - research is required to understand the effect of low velocity projectile impact on the strength carrying ability of composite structures. Objective - the objectives of this research are (1) to develop an understanding to the mechanisms of impact-induced crack propagation in laminated composites, (2) experimentally verify analytically predicted results in compression-loaded laminates, and (3) investigate structural failure due to columns and local buckling. How work contributes - this work will lead to the validation of analytical low velocity projectile impact models which will be employed in the design of composite-containing aircraft.

(1) A method will be developed to measure the rebound velocity of impacting projectiles. (2) Establish a residual strength curve as a function of the energy in both the tension and compression-loaded laminates. (3) Evaluate the scatter in establishing the residual strength curve at different projectile velocities. (4) Assess the effect of preload on the residual strength at different velocities. (5) Verify the validity of the theoretically predicted residual strength values experimentally both in the tension and the compression-loaded laminates.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0050, SILICON CARBIDE EPITAXY FOR ELECTRONIC DEVICES

R.F. Davis, University of North Carolina, North Carolina State University, School of Engineering, Dept. of Materials Engineering, *Raleigh, North Carolina* 27607 (DN975244; N00014-79-C-0121)

This work seeks new approaches to reliability and reproducibly grown silicon carbide of semiconductor grade for use in higher power, higher temperature navy electromagnetic systems.

Cubic (beta) silicon carbide epitaxial films will be grown by organometallic low pressure vapor phase deposition and evaluated for its electronic properties. High pressure, high temperature growth technology will be developed as a backup.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0051, ADAPTIVE ANTENNA ARRAYS FOR AIRCRAFT COMMUNICATION

T. Compton, Ohio State University, Columbus Campus, School of Engineering, Dept. of Electrical Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (DN890051; N00019-80-C-0181)

The objective of this program is to investigate techniques for using adaptive antenna concepts appropriate for use in conventional airborne military communications systems to reduce or eliminate signal interference.

The research study of on adaptive antennas will include (1) an evaluation of the effects of element patterns and signal polarization on the performance of adaptive array systems, (2) investigation of the effectiveness of certain sophisticated jamming signals against array, and (3) preparation of a monograph on adaptive arrays.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0052, DISCRETE CONTROL MODELLING OF SMALL TEAMS

R.A. Miller, Ohio State University, Columbus Campus, School of Engineering, Dept. of Industrial & Systems Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (DF054000; AFOSR-79-0015)

AF function - Air Force operations involve a multitude OC control related information processing and decision-making tasks which are performed by aircrew personnel. Deficiency - this research should make an important contribution to our understanding of how human operators organize the complexity of their task environments and how teams share knowledge and communicate during the performance of a variety of discrete control tasks. Objective - this research will study in detail the structure of manned systems which can be represented by discrete control models. The objective is to obtain both theoretical and empirical insight into the problems of coordination, communication and task performance within small teams of operators. How research contributes - this research is a unique attempt to analyze discrete control decisions of the human operator in a weapon systems contest. It is a direct step toward improved ability to predict manned system performance.

The proposed research will employ both methodological and substantive components with the major objective being the development of the mathematical structure of the discrete control systems used to represent and model manned systems involving small teams of operators.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0053, TURBINE ENGINE CONTROL SYSTEM DEVELOPMENT (IN-HOUSE)

L.L. Small, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF451970)

The objective of this in-house effort is two fold - to develop, fabricate and test high response turbine engine sensors so vitally necessary for advanced propulsion system control, and using this instrumentation as an input and a digital computer as processor, to develop and evaluate new control modes including optimal control techniques for the complex, multi-input and multi-output turbine engine control systems of the future.

The technical approach to this in-house effort consists of several interrelated tasks- (1) development of an analog and digital data acquisition/reduction capability for an engine test cell, (2) development, fabrication, and experimental evaluation of high response gas turbine engine sensors for possible control system applications, (3) analysis of various digital J-85 engine models and updating of these models from actual engine test data, (4) evaluation of classical control schemes with emphasis on closed loop control of unique engine parameters such as compressor discharge corrected airflow and turbine inlet gas temperature, and (5) the evaluation of modern control theory (i.e., using the state variable plant representation) as applied to actual engine control.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0054, ADVANCED COMPONENT TECHNOLOGY

D.F. Kocian, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321170)

This workunit will develop operator-centered display technology for AF real-time reconnaissance and weapon delivery functions. Display concepts will be formulated and prototype equipment developed to enhance man's visual ability to interface with various state-of-the-art and advanced development reconnaissance weapon delivery, teleoperator and simulation subsystems. These concepts involve visually-coupled control/display devices (helmet-mounted sight/display), virtual image display techniques and holographic lens projection techniques. Consultation will be provided for further design, development, and deployment of systems based on these concepts. Efforts are coordinated with tri-service display technology panel members, the Naval Air Systems Command, Naval Air Development Center, Army Night Vision Laboratory, Air Force Armament Laboratory, Aeronautical Systems Division, and the Air Force Office of Scientific Research. This effort supports AFSC development goals, TC-2, TC-4, TC-5, TC-7, and MS-4, PMDR P2033(5)/64708F/5973, visual coupling aids, and TAC ROC 313-74, slewable electro-optical reconnaissance sensor.

Promising state-of-the-art technology in optics, electro-optics and electronics will be applied to develop and evolve operator display subsystems and concepts which enhance overall operator performance in target acquisition and weapon delivery tasks. Design criteria and specifications will be defined for the

interim and advanced helmet display components for the visually-coupled airborne systems simulator (VCASS). Solid state matrix-element image sensing and generating devices will be integrated with new techniques, including holographic diffraction optics, to project images to the operator's visual field. Development of variable resolution and color virtual image displays will be continued. Pseudo-stereo effects and image multiplexing will be demonstrated and their effects on target acquisition defined in the Display/Image Metric Laboratory. Variable transmission visor techniques will be addressed. Display techniques for multisensor information (forward-looking infrared, low-light level TV, radar and laser sensors) will be evolved. This workunit, in part, encompasses work previously reported under Workunit 7184-04-42, Display Concept Development.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Human Engineering Div.

4.0055, OPERATION, MAINTENANCE AND ENGINEERING SERVICES IN SUPPORT OF BIOENVIRONMENTAL NOISE RESEARCH

W. Hovey, University of Dayton, School of Engineering, Dept. of Electrical Engineering, *300 College Park Ave., Dayton, Ohio* 45469 (DF323390; F33615-78-C-0500)

The high-level noise environments generated by many Air Force weapon systems and equipment are a physical hazard to air and ground crew personnel who must function in these environments to assure mission success. These same noise sources pollute the environment in areas adjacent to ground and flight operations. The magnitude and character of these physical environments must be known to evaluate environmental impact, assess bioacoustic effects, and resolve noise-related operational problems. The objectives of this service contract are to provide technical procedures, equipment performance data, and software, and to operate and maintain equipment/facilities required by the Biodynamic Environment Branch (AFAMRL/BBE) for acquiring, storing, retrieving and processing bioenvironmental noise data. These services support workunits 72310704, 72310708, 72310714, 723107AA and 72310807 which provide environmental noise data and predictive models to HQ USAF/LEEV, AFESC, ASD System Program Offices, and MAJCOM/BASE bioenvironmental and civil engineers for use in assessing compatible land use (Air Installation Compatible Use Zone Program), Environmental Noise Impact (AFR 19-2), and Exposure/Protection of Personnel (AFR 161-35).

Operate and maintain the AMRL noisebank and computer interface systems for storing, retrieving, and processing acoustic data. Modify and expand the AMRL Omega series software used to analyze, extrapolate and predict noise environments. Operate a CDC 6600 computer system as required to prepare community noise contours using noisemap. Modify and apply procedures and equipment for evaluating performance characteristics of acoustic transducers, data acquisition/analysis systems and noise simulators. Operate and maintain the AMRL DPC in support of AMRL experimental research.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Biodynamics & Bionics Div.

4.0056, MARITIME PATROL AIRSHIP INVESTIGATION

J.A. Eney, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN881665)

To investigate potential application of lighter-than-air (LTA) vehicles to the current and future requirements of maritime patrol in terms of technical feasibility operational effectiveness and cost.

A systems approach supported by several government agencies has been undertaken to achieve the above objective. Principal areas of the study are the establishment of mission requirements with associated rationale, the performance of missions analysis including tradeoffs and operational effectiveness, the generation of vehicle prametrics, a first order examination of life cycle cost and logistic considerations and a comparison with recent vehicle point designs. Current and near term technology levels will be assumed for structures, materials, and propulsion technologies. While current and future applications of LTA vehicles could coincide with historic applications, methods and approaches to performing these and other missions will be addressed with fresh and innovative thinking. Presuming a positive recommendation for LTA vehicles in a maritime patrol application, a subsequent concept formulation program is planned including LTA vehicle flight demonstrations and wind tunnel testing.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Sea Systems Command

4.0057, INDUSTRY/UNIVERSITY COOPERATIVE PROGRAM - HIGH INTERACTION PARAMETER MAGNETOFLUIDYNAMIC STUDIES IN LIQUID METAL FLOWS

I.R. McNab, Westinghouse Electric Corp., *1310 Beulah Rd., c/o Research & Develop. Ctr., Pittsburgh, Pennsylvania* 15235 (ENG78-08734)

Experimental research is conducted in the field of magnetofluidynamics in which the effects of spatial variations in electrical current magnetic field, and flow velocity on the flow of conducting fluids are determined. The work utilizes a large liquid metal filled closed loop. Flow rates of sodium-potassium alloy up to 65 kg/sec can be achieved using high currents (35,000 amps) and magnetic fields (1.2 Tesla). A specially instrumented diagnostic probe, located within the test section of the liquid metal loop, enables local flow data to be obtained.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0058, MISSILE AERODYNAMIC PREDICTION

W.B. Baker, Arnold Research Org. Inc., *Arnold Air Force Base, Tullahoma, Tennessee* 37389 (DF421126; F40600-77-C-0003)

Available semi-empirical aerodynamic coefficient prediction programs will be set up in an intetactive graphics mode on the IBM 370 and will be exercised for typical missile configurations.

All the prediction programs will be placed on the IBM 370. An interactive graphics program will be written to accept geometric store data. To allow use of any of the prediction programs with this common input an executive program will be written to translate to the parameters required for each aerodynamic coefficient prediction program. The programs will be exercised and the data compared to previous data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering Development Center

4.0059, NONLINEAR HUMAN OPERATOR MODEL IDENTIFICATION FROM OPERATING RECORDS

B.K. Colburn, Texas A & M University, College Station Campus, School of Engineering, Dept. of Electrical Engineering, *P.O. Box F E 44, College Station, Texas* 77843 (DF055370; F49620-79-C-0091)

AF function - an important factor in the design of present and future military weapons delivery systems is the trade-off between machine (computer) control and human operator action. This is especially true of high performance Air Force jet aircraft such as the F-16. Deficiency - with the advent of control configured vehicles (CCV) digital fly-by-wire (DFBW) control systems, the flight/fire control task requirements of the pilot have increased significantly, requiring determination of the limits of pilot control. One way this can be accomplished is by obtaining validated human operator models which can provide prediction of the closed-loop flying qualities under stressed pilot control. Objective - whereas previous work by other investigators generally regarded the human as linear and time-invariant, the proposed research deals with use of the model reference adaptive systems (MRAS) approach to nonlinear operator model identification using only a single input (visual display)-single output (aircraft joy stick motion) type measurement signals. Based on previous work by the principal investigator on MRAS model identification it is proposed to apply the MRAS approach to nonlinear operator models based on operating records of man-in-the-loop simulations. How research contributes - results will provide insight as to the adequacy of the linear op-

timal control model for tracking tasks in CCV configured aircraft.

The general MRAS identifier will be implemented into a general simulator form in software suitable for processing recordings of specific pilot operating records obtainable at the Air Force Flight Dynamics Laboratory, and the existing program will be adapted into a flexible package that will allow inclusion of general nonlinearities. Parameterized nonlinear pilot models will be generated and results will be compared to those available from the optimal control model (OCM) approach using the same data. Results will be used to determine whether any nonlinear responses affect the resulting closed-loop (man plus machine) flying qualities, as well as whether the linear time invariant OCM is adequate for tracking tasks in new CCV configured aircraft. Results of computer data evaluation tasks requiring usage of digital computation will be in the form of human operator models for different operating records along with a comparison of the equivalent OCM.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0060, FLIGHT TEST DATA REDUCTION PROGRAM

B.E. Schutz, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Mechanics, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: A computer program, developed during this continuing line of research, in its fifth year, possesses the capability to process data during a flight test in order to compute the trajectory and aerodynamic coefficients of the flight test vehicle. The data types used are on-board rate gyros, accelerometers, and a stable platform as well as ground-based data consisting of range, range rate, azimuth, and elevation measurements. The program includes several estimation modes and allows the data span to be partitioned into long arc/short estimation of parameters. Several methods for the determination of the evolution of aerodynamic coefficients are being evaluated with particular attention directed toward the accuracy and cost of the determination.

SUPPORTED BY Sandia Lab.

4.0061, (CO) FRACTURE DYNAMICS IN POLYMERIC BINDERS

K.L. Devries, Utah Higher Education System, University of Utah, School of Engineering, Dept. of Mechanical Engineering, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DN780602; N00173-78-C-0091)

The short-lived free radicals generated during the dynamic fracture of polymeric binders will be studied in order to determine their role in the deflagration-to-detonation transition (DDT) in high energy propellents.

This contract provides for (1) the construction of a servo-controlled stress-strain tester and its installation in the NRL high-speed electron-spin resonance spectrometer, and (2) measurements of the free radical sequence in dynamically stressed research grade nylon 6 as a function of temperature.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0062, RESTORING IMAGES DEGRADED BY ATMOSPHERIC TURBULENCE

C.K. Rushforth, Utah Higher Education System, University of Utah, School of Engineering, Dept. of Electrical Engineering, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DF047250; AFOSR-77-3212)

AF function - surveillance and detection of missiles and satellites. Deficiency - degradation of images produced by atmospheric turbulence limits the resolution of large ground-based telescopes. Objective - to produce a practical procedure for achieving increased resolution in the presence of atmospheric turbulence. Contribution -increase of resolution in space images degraded by atmospheric turbulence.

A super-resolution algorithm has been recently developed by the University of Utah based on the work of R. W. Gerchberg. The study of this technique will be continued. A mathematical formulation of the algorithm using the theory of projection operators will be applied to analyze the performance of the algorithm and permit modifications and improvements as required. This algorithm and a modified version of the Knox-Thompson Speckle Imaging technique will be tested on simualted images and real data. The primary emphasis will be on astronomical photographs blurred by atmospheric turbulence. Other applications of the algorithm will be sought to test its generality.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0063, ELECTRICAL CONDUCTIVITY OF GRAPHITE INTERCALATION COMPOUNDS

D.W. Lee, U.S. Dept. of Defense, Army, Mobility Equipment Research & Development Command, Electrical Equipment Div., *Fort Belvoir, Virginia* 22060 (DA0N3751)

To model the behavior of the electrical conductivity of graphite intercalation compounds as an aid in preparing compounds with desired conductivities.

Using appropriate instrumentation, the conductivity of fibers, crystals and wires will be determined over the temperature range from 4 to 300K. Results will be used to model the conductivity.

SUPPORTED BY U.S. Dept. of Defense, Mobility Equipment Research & Development Command, Electrical Power Lab.

4.0064, HYBRID POWER SOURCE FOR ELECTRIC PROPULSION

J.B. O'Sullivan, U.S. Dept. of Defense, Army, Mobility Equipment Research & Development Command, Electrochemical Div., *Fort Belvoir, Virginia* 22060 (DA0K3768)

To evaluate the advantages of a hybrid power source (fuel cell-battery) for electric propulsion. The immediate application to benefit from increased efficiency, improved performance and reduced emissions is material handling equipment in enclosed areas. To provide information on cost, maintenance, performance and efficiency for decisions regarding broader military application.

(1) Design on paper most efficient regulator circuit for limiting fuel cell current and battery charge voltage. (2) Calculate cost and weight advantages of single nominal 36 V fuel cell module based on current state-of-the-art units; write specifications. (3) Perform calculations as in (2) for 72 and 96 V applications. (4) Contact various manufacturers for system costs as a function of units/year and marketability studies to assess civilian interest and its impact on future costs to the Army. (5) Investigate means of cooling the battery and means to lower internal resistance of batteries. (6) Acquire a regulator, fuel cell, battery and put together. (7) Construct a methanol reformer to supply hydrogen to the fuel cell and evaluate its operation in the system. (8) Evaluate system on bench, then operate it in a fork lift truck.

SUPPORTED BY U.S. Dept. of Defense, Mobility Equipment Research & Development Command, Electrochemical Div.

4.0065, IONOSPERIC ELECTRON CONTENT MEASUREMENT

Z. Houminer, Radio Observatory, *Haifa, Israel* (DA0E9305; DAERO 79 G0020)

The objective is the continuous monitoring of the total electron content above Haifa using the 136.14 MHz transmissions of the SIRIO satellite. The diurnal, seasonal and solar activity dependence on TEC will be determined.

The TEC measurements will be carried out at the Radio Observatory Laboratories at Haifa using a flarimeter system received on loan from the US Army Communication Command.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

4.0066, TASK LOAD AND OPERATOR ATTENTION CAPACITY IN TIME SHARING PERFORMANCE
D. Gopher, Technion, *Haifa, Israel* (DF046760; AFOSR-77-3131)

AF function - this research supports aircrew training, aircrew performance in high task load environments (e.g., combat), and overall Force readiness. Deficiency - as the role of the pilot is shifting from a direct controller of aircraft functions to a monitor and decision maker in a complex, dynamic, and intelligent man-machine system, we need to measure those abilities which support this new role. The increasing complexity of flight missions combined with the growing sophistication of airborne systems and the concurrent increase in production and training costs emphasize the need for improved assessment techniques for pilot attention capacity and task loads. Objective - the research activity will follow three major lines - (1) development of a quantitative assessment of time sharing efficiency, (2) training for time sharing, and (3) development of software packages, including feedback devices and adaptive techniques. How research contributes -improved techniques and prediction equations for the evaluation of task load and operator efficiency in time-sharing situations will be utilized in system design and development, the structuring of aircrew training programs, and the assessment of the workload quotient of various tactical maneuvers.

This research will be devoted to achieving the following goals - 1) experimental investigation of single vs. multiple resource interpretations of time-sharing behavior in a wide variety of verbal, perceptual and motor tasks, 2) identification of the major categories and description of the effects of the factors responsible for interference in time-sharing performance, 3) determination of the benefits and costs of integrability vs. separability of tasks in concurrent performance, 4) investigation of effects of different training procedures on time-sharing performance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0067, VHF-UHF DEEP FADING
A. Bushby, Instituto Geofisico del Peru, *Huancayo, Peru* (DF584060; AFOSR-80-0040)

AF function - communications, radar. Deficiency - signal-fading causes high error rates in communications, loss of signatures in radar identifications. Objective - to determine and predict effects of the equatorial ionosphere on signals transmitted by satellites. How research contributes - predicts and maximizes message reliability. This work continues VHF, UHF and gigahertz observations in Peru. The work includes observations at Arequipa of scintillation and total electron content.

VHF and UHF satellite signals will be observed at three locations in Peru, and gigahertz signals at one location.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0068, REDUCTION OF AERODYNAMIC DRAG
J.E. Field, University of Cambridge, Cavendish Lab., *Madingley Rd., Cambridge, England, United Kingdom* (DF054520; AFOSR-79-0057)

AF function - advanced aerospace vehicles. Opportunity - to provide understanding of the effect of small radiation amounts on the molecular structure of air and other gases. Objective - to study the mechanisms of viscosity by reduction at the molecular level of air and various other gases when bombarded with low-level radioactive emissions. How work contributes - this effort will research the control of viscosity by radiation. If successful, it could provide an effective method for control of aerodynamic drag and a possible method for retarding the transition to turbulence. The author postulates that this method is similar to the effect of long-chain polymers in liquids.

A flow channel will be used to determine the effect of alpha and beta bombardment of a surface on its skin friction drag. First a friction gauge will be constructed on the channel wall, later the drag on suspended shapes will be attempted. Gaseous systems of air, nitrogen and oxygen with varying amounts of humidity will be used. In addition to the friction balance, hot wire and magnetic probe measurements will be taken.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, EVOLUTION OF OLYMPUS MONS
E.C. Morris, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeological Studies, *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (0-9580-02357)

Detailed maps of the sequence of flows on the flanks of Olympus Mons, the basal plains and a detailed map of the aureole deposits will be completed. The age sequence of the various units will be determined from crater statistics and stratigraphic and tectonic relationships. Reports will be prepared on the results of the investigation.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0002, VOYAGER
L.A. Soderblom, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeologic Studies, *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (0-9580-01031)

Voyager I and Voyager II encountered Jupiter and the four large Galilean satellites on March 5 and July 9, 1979, respectively. Preliminary analysis of the data are continuing and the final project report on the Jupiter systems will be prepared and submitted for publication. Concurrently advanced studies have begun in the areas of (1) thermodynamic modeling of active volcanism on Io; (2) model studies of the surface of Europa including crustal expansion, erosion by sputtering, and global spectral studies; (3) geologic mapping of Ganymede to classify the tectonic relationships and their relations to stratigraphic and relative ages based on crater density; (4) comparison of Callisto and Ganymede particularly to compare the ancient crusts which seem to have similar styles and evolutions; (5) study of overall chronology based on the distributions of impact craters on Ganymede, Callisto, and Europa. Additionally, plans are being completed for Voyager I encounters with Saturn and its satellites on November 13, 1980. During that encounter the planetary satellites Mimas, Tethys, Dione, and Titan will be explored at close hand.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0003, LUNAR BASINS
L.A. Soderblom, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeologic Studies, *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-01331)

During the final year of the project the goal is for Grolier to complete and publish a pictorial and bibliographic 'Catalogue of Terrestrial Impact Craters' using LANDSAT and aerial photography. Over one hundred likely impact features are being included.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0004, SOUNDING ROCKET PERFORMANCE
Unknown, Aerojet General Corp., *9200 E. Flair Dr., El Monte, California* 91734 (DF261010; F19628-68-C-0277)

AF function - reconnaissance, surveillance, communication and advanced weapon systems. Deficiency - inability to forecast atmosphere interactions affecting the design and operation of military systems such as reentry vehicles, over-the-horizon radar and satellite operations. Research - a program to allow definition of the aerospace environment requires performance of experimental measurement by rocket payloads. To provide reliable and complete data collection from these measurements, preflight

analysis of potential failure modes is conducted under this work unit. How research contributes - improves efficiency of data return from experiments measuring those aerospace parameters of importance to Air Force systems operations and predictions of atmospheric interactions. The work consists of studies relating to the use of sounding rockets. Analyses in several areas such as performance, thermal problems, vibration effects, structures, etc. are accomplished with construction of prototypes to test hypotheses.

SUPPORTED BY U.S. Dept. of Defense, Geophysics Lab., Aerospace Instrumentation Div.

5.0005, ENGINEERING SERVICES
N. Laux, Aerojet Liquid Rocket Co., *P.O. Box 13222, Sacramento, California* 95813 (DF582230; F19628-77-C-0182)

AF function - in-situ aerospace research using sounding rockets. Deficiency or opportunity - need to maintain specific pointing angles for rocket-borne payloads, and for rocket components. Objective - to provide an attitude control system (ACS), launch vehicle and analytical services, and cost-effective kick-stage rocket motors for sounding rocket probe vehicles. How development contributes - provides necessary pointing control instrumentation, kick-stage motors and field services to support scientific investigation of the Earth's environment.

The contractor will provide the attitude control system, fabricate and test kick-state motors and refurbish them after flight for reuse, provide launch support at White Sands Missile Range, N.M. and perform engineering analysis as directed. The ACS technical support personnel will perform engineering, air-bearing testing, integration with the payloads and field services for the ACS at White Sands Missile Range, N.M.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0006, ENVIRONMENTAL HYDROLOGY OF THE SNOW OF SIERRA NEVADA AND THE COAST RANGES OF CALIFORNIA
J.L. Smith, U.S. Dept. of Agriculture, Forest Service, Pacific Southwest Forest & Range Experiment Station, *P.O. Box 245, Berkeley, California* 94701 (0000005; PSW-1601)

OBJECTIVE: Determine, quantify, and model the hydrologic principles affecting snow accumulation and melt and develop their use in multiple-use management of the forest of snow zone of California. In other terminology, to develop the basic knowledge with which accurate predictions can be made to the effect of management activities, or the lack thereof, upon the snowpack regime and upon subsequent effects of vegetaion, soil moisture, streamflow and other ecological parameters.

APPROACH: Expand the basic information gained from in-depth studies at one altitude-latitude into models and expand this data base to cover a mosaic of altitude-latitude, slope, aspect, cover conditions. From this data expanded models will be developed with which one may pre-estimate a change in snowpack resulting from weather modification, or from cover change, and from this the expected ecological consequences.

PROGRESS: Publications have been prepared with which one may evaluate the ecological and snowpack response to weather modification in the Sierra Nevada, California. These report on simulated effects on precipitation for 74 years and on snowpacks for 27 years. Panels of experts evaluated the impacts in five major ecological fields. A 1374 citation bibliography has been prepared. An assessment of the major concerns expressed by the public and our evaluations of their potential for impact has been prepared. These publications may be used for preparation of environmental impact reports and their review and for determination of the usefulness of weather modification to alleviate drought stress on plants, the effect on potential floods, etc. Information is useful to land and water managers for planning, application, and evaluation of weather modification projects to obtain more water. A method has been developed for estimating average snowpack density by measuring solar albedo at the survey site at 1 meter above the snow when latitude, date and type of precipitation, and date of latest precipitation are known. If the two values, snow depth and snow density, are known, the water content of the pack can be estimated. The data can then be used to forecast water supply. A study is now underway to test this system by measuring albedo from a helicopter. Snow depth can be measured from the air.

SUPPORTED BY U.S. Dept. of Agriculture, Forest Service, Pacific Southwest Forest & Range Experiment Station

5.0007, OCEANOGRAPHIC STUDIES IN SUPPORT OF COMOCEANSYSPAC (COSP)
G.H. Jung, U.S. Dept. of Defense, Navy, Naval Postgraduate School, *Monterey, California* 93940 (DN098059)

Continue with studies to evaluate the NOAA GOSSTCOMP product and to investigate long range acoustic propagation through frontal regions and eddies in the North Pacific Ocean.

Problems identified as important to cosp are developed as thesis projects at NPS. These include (1) analysis of long range acoustical experiments made in conjunction with the mixed layer experiment (MILE) in the North Pacific in 1977 in changing environmental conditions; (2) comparison of the NOAA Global Operational Sea Surface Temperature Computation (GOSSTCOMP) from satellite measurements with ground truth and with fleet numerical oceanography center chart values; and (3) evaluation of effects of ocean frontal systems and eddies on long range propagation of low frequency sound in the North Pacific Ocean.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Ocean Systems Center

5.0008, INVENTORY AND CLASSIFICATION OF VOLCANIC FEATURES
C.A. Hodges, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *345 Middlefield Rd., Menlo Park, California* 94025 (9580-02359)

We expect to do a detailed follow-up on our preliminary survey of mosaics made from Viking orbiter photographs, with the intent of formulating a scheme for classification and cataloging such landforms so that analyses and interpretations can be conducted systematically. An atlas of possible and probable volcanic landforms on Mars, together with appropriate terrestrial analog candidates and summary interpretations, should be approaching completion by the end of the year.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0009, SEAREX - SEA-AIR TRANSPORT-LASER ANALYSIS OF GAS PHASE METALS
E.D. Goldberg, University of California, San Diego Campus, Scripps Institution of Oceanography, *P.O. Box 1529, La Jolla, California* 92038 (OCE77-23766)

SEAREX is a multi-disciplinary, team-managed project aimed at understanding material transport between the atmosphere and sea surface of the major oceans. Particulate matter in air is trapped in tower-mounted collectors on two mid-Pacific islands near the equator. Material leaving the sea surface as bubble-induced spray and by evaporation is also collected. Analysis of this material for stable metals, radiochemicals, and organic matter is combined with measurements of accumulation rates to assess flux of major classes of pollutants. Results of this study will provide some of the basis for global models describing how pollutants interact with the oceans.

This award supports the development of a laser resonance fluorometer for analyzing metal species in the atmosphere. The low concentrations detectable by this instrument will assess metal fluxes from sources important to baseline inputs such as rocks seawater, forests, and volcanoes. Previous samplings have not taken these sources into account though they may be very important to overall ocean-atmosphere interactions.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0010, REMOTE SENSING

B.L. Trotter, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (8AA79300)

PROJECT OBJECTIVE: To transmit real-time processed radar weather data from selected National Weather Service radar sites to Boulder, Colorado for purposes of analysis and prediction.

CURRENT YEAR PLAN: To review proposals from prospective vendors who will supply the data links between the local and remote radar terminals. Recommend a vendor and assist with the contract negotiations.

SUPPORTED BY U.S. Dept. of Commerce, Environmental Research Lab., Prototype Regional Observation & Forecasting Services

5.0011, GEOMAGNETIC APPLICATION TO CRUSTAL STUDIES

W.H. Campbell, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Regional Geophysics Branch, *Box 25046, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9730-01820)

The long-range objective of the present research program is to provide the geomagnetic studies that can lead to an improvement of the reliability in the type of geomagnetic mapping that is useful in navigation and in the evaluation of the location and nature of the Earth's crustal materials. Project plans and objectives for the current fiscal year are: 1) Further study of the large currents induced in the Alaskan oil pipeline at times of major high-latitude geomagnetic disturbances for locations north of Fairbanks. The purpose is to understand the distribution of these currents as a function of geological conditions, source location and source scale variations. 2) An analysis of the quiet daily Sq geomagnetic field variations at North American locations to understand their contribution to errors in mapping techniques. 3) A study of geomagnetic spectra at periods of 4 hrs. and longer to determine how such background field levels affect main field and small-scale magnetic anomaly mapping.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0012, REMOTE SENSING STUDIES IN THE AJO 2-DEGREE QUAD, ARIZONA

G.L. Raines, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *Box 25046, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9790-02242)

STATES TO WHICH PROJECT PERTAINS: Arizona and New Mexico.

The objectives are to (1) develop and improve remote sensing data acquisition, processing, and analysis techniques for application to geologic interpretation; (2) define a regional tectonic framework relevant to mineralization; (3) produce a hydrothermal alteration map to the Ajo and Silver City 2-degree quandrangles; and (4) begin geologic studies of several newly discovered hydrothermal systems.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0013, TETHERED BALLOON PROFILES

J. Deldo, Florida Inst. of Technology, School of Aeronautics, *Melbourne, Florida* 32901 (DN075612; N00014-80-C-0574)

The objective of this research is to measure potential differences between the ionosphere and the Earth for the purpose of looking for correlations between solar and terrestrial events that may give clues to change in weather conditions that would be useful in planning naval operations.

A specially constructed balloon will be used that is capable of remaining erect on its tether in a fairly strong wind. This property insures a reasonably constant height of the measuring platform. A voltage supply on the ship will be used to null out the potential difference between the height of the balloon and the deck of the ship. the voltage at null reading will be proportional to ionospheric voltage. In addition to this measurement, meteorological sensors various heights on the tether will furnish a meteorological profile of the marine boundary layer.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0014, FIELD MEASUREMENTS OF MESOSCALE WEATHER SYSTEMS

J.J. Stephens, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Meteorology, *205 Wildwood Dr., Tallahassee, Florida* 32306 (ATM78-27420)

The primary goal of this research is to develop comprehensive data sets that serve to (1) verify numerical mesoscale models and provide real data model initialization and (2) yield statistics suitable for the experimental design of a complete mesoscale experiment. During the first year support is provided for the analysis of previous data and for the collection and reduction of data from two Doppler radars, an automated mesoscale surface meteorological network, and two meteorologically instrumented aircraft which are participating in SESAME (Severe Environmental Storms and Mesoscale Experiment) in Oklahoma. Additional radar, surface, rawinsonde and aircraft data will be available from other SESAME participants and will be included in the subsequent comprehensive data sets and their analysis. In addition to providing unique data sets for numerical modeling studies the observational program will provide data to develop improved experimental designs for future mesoscale experiments.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0015, SATELLITE OCEANOGRAPHY IN SUBTROPICS

O. Brown, University of Miami, D.H. & Lewis Rosenstiel School of Marine & Atmospheric Sci., *4600 Rickenbacker Cswy., Coral Gables, Florida* 33149 (DN975819; N00014-80-C-0042)

Remote sensing by satellite offers the possibility of synoptically monitoring the surface conditions of the ocean from input to oceanographic and sonar prediction models. These observations are not possible any other way on any significant scale. This project attempts to relate, quantitatively, satellite infra-red sensor returns with ocean thermal processes, in order to interpret and expand satellite data coverage.

Satellite thermal imagery will be collected and processed in conjunction with independently collected in-situ ocean data. Algorithms will be developed for the interpretation of the satellite data in terms of oceanic processes, and the resulting sea surface temperature fields analyzed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0016, NAVY ENVIRONMENT - TRANSIENT PROCESSES IN OCEAN CURRENTS

W. Duing, University of Miami, D.H. & Lewis Rosenstiel School of Marine & Atmospheric Sci., Dept. of Marine & Atmospheric Sciences, *4600 Rickenbacker Cswy., Coral Gables, Florida* 33149 (DN575081; N00014-75-C-0173)

Increased knowledge of the spatial and temporal variability of oceanic current systems is essential if the Navy is to improve its ASW capability. Not only do these induce changes in sound propagation characteristics needed for ASW, but they also affect other missions such as search and rescue and salvage operations.

Direct ovservations are made of ocean current systems such as the Somali current and equatorial undercurrent. These observations include moored current meters, CTD, and XBT profiles. In addition, infrared sea-surface temperature maps are obtained from satellites (such as DMSP) for use in tracking the surface expression of these currents.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0017, STUDY OF SURFACE WINDS AND SEA SURFACE TEMPERATURE OVER THE WESTERN INDIAN OCEAN USING SEASAT-A DATA

M.A. Estoque, University of Miami, D.H. & Lewis Rosenstiel School of Marine & Atmospheric Sci., Dept. of Meteorology & Physical Oceanography, *4600 Rickenbacker Cswy., Coral Gables, Florida* 33149 (7-979-3; NA79SAC00737 MOD. #1)

OBJECTIVE: In association with MONEX Experiment, the proposed work will focus on (1) the validation and calibration of SEASAT-A surface wind and SST data vs. independent observational data, (2) a detailed study of the synoptic features of the surface wind field associated with monsoons, and (3) a corresponding study of sea surface temperatures and their interrelationships with surface wind.

APPROACH: Construct detailed distributions of the surface wind and the sea surface temperatures. A streamline-isotach analysis will be done to produce detailed maps of surface wind distribution; corresponding maps will be drawn for sea surface isotherms to exploit the horizontal (100 km) and time (36 hr.) resolution of the SEASAT-A data. Maps based on these data will, in turn, be validated and corrected against independent observations. Finally, the corrections will be incorporated in producing the final surface wind and sea surface temperature distributions.

CURRENT PLANS: Continue plotting and analysis of conventional surface meteorological data over the Indian Ocean, particularly surface winds and temperature. When SMMR data become available, obtain estimates of vertically integrated moisture content and initiate analyses of infra-red cloud imagery.

PROGRESS: Analysis of eight (8) scatterometer tapes is underway. About half of the surface meteorological data from Indian Ocean ships and weather stations have been analyzed.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0018, A STUDY OF PROPAGATION OF NMMW RADIATION THROUGH CLEAR AIR AND FOG (17236-GS)

R.A. Bohlander, Georgia Inst. of Technology, Engineering Experiment Station, *225 North Ave. N.W., Atlanta, Georgia* 30332 (DA0G2744; DAAG29-80-K-0005)

To investigate the anomalous attenuation of millimeter waves in a field environment using MMW spectroscopic techniques. Relevance: This research is relevant to the Army Atmospheric Transmission Program in establishing the magnitude, possible causes and the meteorological variables associated with anomalous water vapor attenuation.

A Fourier transform spectrometer (FTS) capable of operating as low as 200 GHz and producing an interferogram in one minute will be used in conjunction with the Harry Diamond Laboratory millimeter wave facility (MMF) to investigate anomalous and variable water vapor attenuation. The MMF will operate at fixed frequencies of 94, 140, and 220 GHz. The FTS will provide information over the band 200-1000 GHz and will greatly supplement the MMF data as well as provide data on any spectral features of the anomalous attenuation. The FTS and MMF data will be further supplemented by detailed meteorological measurements provided by the Atmospheric Sciences Laboratory's atmospheric characterization system. The sum of these three simultaneous efforts will be unique and greatly increase our understanding of this important and poorly understood phenomenon.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

5.0019, STUDY OF THE INTERACTION BETWEEN EQUATORIAL AND HIGHER LATITUDES DURING WINTER MONEX

C.S. Ramage, University of Hawaii System, Manoa Campus, School of Arts & Sciences, Dept. of Meteorology, *2444 Dole St., Honolulu, Hawaii* 96822 (ATM78-10494)

The objective of this reserach is to investigate the space and time changes in equatorial-mid-latitude atmospheric interactions over southeast Asia. This research is an integral part of the U.S. involvement in the Monsoon Experiment (MONEX).

MONEX a regional subprogram under Global Atmospheric Research Program (GARP), is a major study to increase our knowledge and understanding of the dynamics and thermodynamics of the atmosphere and ocean in monsoon regions. Three research areas have been identified for this experiment. They are the Arabian Sea, the Bay of Bengal, and Indonesia-Malaysia. This work concentrates on the Indonesia-Malaysia region. MONEX is important scientifically and also has signficance for global agriculture, economics and politics. In addition to the benefits mentioned above, MONEX offers an excellent opportunity for scientific and technical cooperation between, and of mutual benefit to, the U.S., India, the USSR, Indonesia and Malaysia.

Other specific research goals of this project are to: (1) Investigate the character, extent and intensity of major events over the 'maritime continent' (Indonesia-Malaysia) and their relation to the surge-lull cycle, helping to improve near-equatorial weather forecasting; and (2) estimate large-scale air-sea heat exchange over the China Seas.

A special set of MONEX observations will be collected by the PI from nine automatic surface meteorological stations on islands surrounding the maritime continent.

The PI will use these conventional and other special MONEX data to carry out his research goals.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0020, NAVY ENVIRONMENT - AIR DEPLOYED BUOY MOORING ANALYSIS

L. Bonde, E G & G Inc., Analytical Services Center, *2150 Fields Rd., Rockville, Maryland* 20850 (DN323169; NOOO14-79-C-0227)

The Navy's Ocean Science Program has a requirement for more synoptic data on major oceanographic events. A candidate approach for meeting this requirement is the utilization of an air deployable oceanographic mooring. This procurement provides for the system engineering and integration of various recently developed subsystems into a single air transportable package.

The contractor will act as a focus for the project and establish interfaces between the various air deployable oceanographic mooring subsystems. Engineering analysis of the system as a whole will be conducted to insure that all missions of the system can be met. Test units will be fabricated for field trials using in-house equipment and expertise.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0021, IONOSPHERIC SCINTILLATION AND TOTAL ELECTRON CONTENT STUDIES

S. Basu, Emmanuel College, Graduate School, *400 the Fenway, Boston, Massachusetts* 02115 (DF580080; F19628-78-C-0005)

AF function - communication and navigation. Deficiency - satellite communication and navigation systems are subject to fading and timing errors. Objective - develop physical and statistical models of ionospheric irregularities in order to predict the morphology of scintillation and the variability of total electron content (TEC). How research contributes - defines the temporal and spatial variability of scintillation and TEC and allows the prediction and alleviation of detrimental effects on operational systems.

Experimental data on the occurrence of scintillation and variability of TEC will be correlated with Jicamarca backscatter maps, satellite data, geophysical parameters and F0F2, to develop and test theories on the generation and evaluation of F-region irregularities for different geographic locations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, RESEARCH LEADING TO THE DEVELOPMENT OF INSTRUMENTATION FOR RESEARCH ROCKETS SUPPORT AND INSTALLATION AT ROCKET LAUNCH SITES

S.J. Rochefort, Northeastern University, School of Engineering, Dept. of Electrical Engineering, *360 Huntington Ave., Boston, Massachusetts* 02115 (DF247220; F19628-76-C-0111)

AF function - research leading to the development of state-of-the-art airborne instrumentation systems. Deficiency - the inability to accurately forecast the atmospheric interactions affecting the design and operation of military systems in the area of rockets and satellites. Objective - to perform studies leading to the design, construction and flight test of state of the art airborne instrumentation systems. Such studies will attempt to improve present day systems by more efficient utilization of transmission bandwidths. Provide field support - carry on post-flight analysis of performance and provide continuing improvement. How research contributes - the development of more efficient airborne data processing techniques and instrumentation systems will allow more efficient use of RF bandwidth within the limited allowed band.

Theoretical development of more efficient telemetry systems for use in rocket, satellite and balloon instrumentation systems. Construct these telemetry systems for flight - provide field support - carry on post-flight analysis of performance. The closed loop will ensure rapid response to current needs. The design objectives of space, weight and power. The vast experience accumulated through previous contracts should ensure efficient use of valuable Air Force funds.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, DATA ANALYSIS FOR DEVELOPMENT OF NEW MODEL ATMOSPHERES

L.G. Jacchia, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (DF581700; F19628-78-C-0126)

AF function - orbital navigation, orbital surveillance. Deficiency - ephemerides of operational satellites cannot be computed accurately due to lack of knowledge of spatial and time variations of density at critical altitudes. Objective - participation in the analysis of thermospheric data and the development of new, improved models of the neutral upper atmosphere. How research contributes - new models, which will include work done on this contract, can be recommended for use by COESA in the development of revised US standard supplements and by the NORAD Cheyenne Mountain Space Computation Center for ephemeris computations.

Analysis of satellite, rocket, and ground-based measurements of atmospheric properties will be utilized in the development of new model atmospheres. AE and S3 satellite accelerometer data and coordinated composition data will be used in the development of a model representing neutral atmosphere variations related to geomagnetic activity in the lower thermosphere. A wide range of satellite data and other correlative data will be analyzed and evaluated for the determination of atmospheric properties as part of the development of dynamic models of the structure of the upper atmosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, COHERENCE TIME OF IONOSPHERIC REFRACTION

R.S. Allen, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580890)

AF function - advanced radar and navigation systems. Deficiency -the sensitivity of radars which track deep space targets is severely limited by rapid loss of radio phase coherence caused by the time rate of change of refractive effects within the ionosphere. Objective -develop a technique to predict median coherence times for existing and proposed ADCOM radars which must perform deep space surveillance. Provide ADCOM with estimates of the hour-to-hour variability of the refractive effect with respect to its median value. How research contributes - provides basic statistics on coherent integration time which can be used in system design and trade off evaluations for range extension to SPADATS radars and for the deep space surveillance radar system.

Use AFGL models and data to develop a technique to predict the median coherent integration time for existing and proposed ADCOM radars. Acquire and analyze observations representative of deep space radar sites to estimate the hour-to-hour variability of the coherent integration time.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, SHUTTLE EXPERIMENT FOR ULTRAVIOLET HORIZONS MEASUREMENT

R.E. Huffman, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581310)

AF function - spacecraft guidance and control, target detection and tracking, surveillance. Deficiency - insufficient information on ultraviolet horizons to develop horizon seconds. Objective - development of a spectrometer/telescope instrument package to measure the ultraviolet horizon from a satellite or shuttle, including altitudinal variation, global variation and spectral characteristics. How research contributes - the radiance from the Earth's atmosphere as a function of the viewing direction is the primary measurement required to develop improved horizon sensors for spacecraft altitude control. The stability, spectra, and intensity will be obtained from the instruments developed under this workunit.

The horizon limb profiles will be measured in the ultraviolet and vacuum ultraviolet wavelength regions using small spectrometers. These Ebert-Fastie spectrometers will allow the necessary wavelength band discrimination. A telescope will isolate a small field of view. Prototype units will be tested in regard to sensitivity as a function of wavelength and irradiation direction. A group of these modules will be incorporated into a satellite or shuttle experiment.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, AUTOMATION OF AIRFIELD WEATHER SYSTEMS

R. Lynch, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584330)

AF function - weather observing for military operations such as the launch and recovery of military aircraft. Deficiency - advanced and highly automated weather observing and dissemination systems deployable to satisfy both fixed and tactical bare-base airfield requirements. Objective - to exploit rapidly-evolving technology advances in the microprocessing field to test and evaluate alternative automated weather system configurations. How development contributes - thorough examination of automated weather system components and configurations will make available advanced systems optimized to particular airfield requirements and permit timely and accurate weather observations, warnings and forecasts.

The weather test facility (WTF) at Otis AFB, MA provides the observational capability for the detailed examination of weather phenomena critical to safe and effective launch and recovery of aircraft. A state-of-the-art microprocessor-based and automated data processing system has been established at the WTF drawing on the experience gained through the test of a prototype modular automated weather system (MAWS) at Scott AFB, IL during FY77-79. Advances in component design, signal processing and display techniques will be integrated into the microprocessor system as they evolve and be subjected to test and evaluation. New and/or modified sensing techniques will be integrated into system configurations after undergoing independent test and evaluation. Emphasis will be placed on improved automated solutions to cloud cover, ceiling height, weather discrimination, wind direction and speed and airfield visibility parameters. Short range forecasting techniques, which will be developed in other workunits of Task 667010, will be integrated into candidate systems and evaluated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, AURORAL AND AIRGLOW BACKGROUND STUDIES

R.M. Nadile, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580360)

AF function - atmospheric infrared backgrounds. Deficiency - lack of knowledge of infrared properties of the atmosphere. Objective -develop an auroral and airglow background emission model based on visible and infrared field measurements. How research contributes -accurate modeling of auroral and airglow emissions will provide a background predictive capability which can be used to evaluate future AF surveillanoe system designs.

An infrared auroral and airglow background predictive capability will be developed for selected spectral regions of interest to Air Force surveillance missions. This capability will be achieved through an analysis of an existing infrared data base, its comparison with simultaneous visible measurements, and their incorporation into a theoretical model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, SOLAR VARIABILITY

D.F. Neidig, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584750)

AF function - communications, surveillance, detection, tracking. Deficiency - the role that solar energy output changes play in terrestrial atmospheric conditions and long range weather patterns is unknown. Objective - determine the level to which the sun varies its energy output in all wavelength bands, the effects of these variations, and the diagnostic indicators of this variability. How research contributes - if the air force could detemine the levels to which long term (time scale of years) solar energy output variations occur, this could serve as an imput into upper atmosphere models and long range weather prediction.

Changes in the near-ultraviolet spectral region will be determined by continued synoptic observations of outer-planet and planetary-satellite brightnesses. The brightnesses of these objects, when compared with standard star measurements, presumably represent changes in the solar energy output. Previous observations indicate a 2 percent brightness change per year in objects with atmospheres and a possible 0.3 percent change in objects without atmospheres. Long term observations of these changes are needed. Complementary observations to determine whether similar variations exist on other solar-type stars are also planned. Satellite observations of the sun will extend this study to the extreme-ultraviolet (EUV) spectral region. Studies of accompanying solar diagnostics, such as solar rotation rate changes, will be made at the Sacramento Peak Observatory.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0029, ANALYSIS AND MODEL DEVELOPMENT OF UPPER ATMOSPHERE SPECIES

C.R. Philbrick, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582880)

AF function - operation of satellite systems in the upper atmosphere. Deficiency - prediction of orbital ephemerides due to changes in the neutral atmosphere and specification of ionospheric disturbances that degrade satellite communications. Objective - to investigate the effects of solar and geomagnetic storms on the structure of the upper atmosphere and ionosphere in order to specify the physical processes involved and to model the atmospheric response. How research contributes - improved modeling of the response of the neutral atmosphere to geomagnetic storms will improve orbital element prediction and reduce the number of tracking passes needed to update orbital elements during disturbed periods. Modeling of ionospheric variations will improve specification of ionospheric propagation effects.

Data obtained from the S3-1 and S3-2 satellites and from rocket flights will be analyzed and the results used to develop empirical models of the response of the atmosphere to geomagnetic storms. Comparisons will be made with other data currently available which would help in developing the modeling and analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0030, STATISTICAL ATMOSPHERIC OPTICAL MODELS AND WEATHER

E.P. Shettle, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583110)

AF function - reconnaissance, communications, surveillance, guidance, target acquisition and tracking. Deficiency - the performance of any electro-optical system looking through the atmosphere is significantly degraded by atmospheric light scattering and absorption. Therefore, it is dependent in a complex way on the variability of the state of the atmosphere in the theater of operation. Objective - develop operational models of the atmospheric effects on the propagation of optical/IR radiation, especially the properties of the atmospheric particulates, and the scattering properties of the atmosphere. How research contributes - development of such models of the atmospheric aerosol properties will lead to an improved ability to model and predict the effects of the atmosphere on the performance of E/O systems. Examples of such effects include the modeling of the slant path contrast reduction which limits the operational capability of precision guided munitions, or predicting the probability of detecting laser systems from off-axis scattering of the laser beam.

Develop or update models of the atmospheric aerosol optical properties based on such inputs as the experimental efforts under this project (7670), and the analysis and correlation studies carried out under CWU 762111AF. These new models will include an optical climatology of Europe and statisical characterization of the properties of atmospheric aerosols and their relation to meteorological conditions. The models will be refined for use in optical propagation programs such as LOWTRAN or the contrast transmission computer codes. These models with the propagation codes can be used to derive nomograms or analytic expressions for the prediction of atmospheric effects on E/O systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0031, CIRRIS SPACE SHUTTLE EXPERIMENT DESIGN

D.R. Smith, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584530)

AF function - space-based IR surveillance, satellite detection and intercept. Deficiency - lack of IR data on the spectral, spatial and temporal characteristics of the atmosphere especially during disturbed conditions. Objective - design instrumentation and experimental approach for the infrared background measurement program from Space Shuttle called Cirris. How research contributes - a comprehensive IR data base will allow accurate modeling or IR atmospheric emission from the Earth limb for optimization of AF system designs and assessment of system capabilities and limitations.

Design an IR sensor and instrumentation package for a future Space Shuttle experiment. This design will lean heavily on existing technologies in the areas of cryogenic interferometers and telescopes developed at AFGL under the ICECAP, HIRIS, SPIRE and IRBS programs. The experiment will be designed to meet both AF system requirements and basic phemonenology and atmospheric modeling needs. The design and instrumentation will meet all NASA and STP shuttle specifications but should also be adaptable to a rocket probe flight as an alternative.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0032, LOW ENERGY PLASMA MOTION

P.J. Wildman, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF248940)

AF function - communication, surveillance and navigation. Deficiency - inadequate knowledge of bulk motion of ionospheric and magnetospheric plasma inhibits prediction of ionospheric irregularities and density gradients. Objective - use plasma bulk measurements to improve modeling of ionospheric dynamics at all latitudes. Develop improved instrumentation. How research contributes - permits prediction of mid-latitude trough and plasma morphology at high latitudes.

Data for PHR experiments on S3 series satellites will be analyzed to determine plasma bulk motions, and their variation with geophysical parameters. Criteria for improving instrumentation will be developed during the examination of the experiment data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0033, MEASUREMENTS OF DIFFERENTIAL CROSS-SECTION OF SECONDARY ELECTRONS EJECTED FROM ATMOSPHERIC GASES BY ELECTRON IMPACT

T.W. Shyn, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Atmospheric & Oceanic Sciences, *Ann Arbor, Michigan* 48104 (ATM79-01618)

An important process in the upper atmospheres of planets is the interaction of electrons with neutral atoms and molecules. The interaction consists of elastic and inelastic scattering processes including ionization of the particles by electron impact. Electrons, particularly those produced as a result of ionization of atmospheric gases, lose their energy principally in inelastic collisions and elastic collisions, and eventually become a part of the thermal electron population at the end of the cascade energy loss process. The understanding of the energy deposition (energy lost) by energetic electrons in a particular gas or mixture of gases requires a comprehensive and consistent set of cross-sections describing the primary and subsequent (secondary) events taking place in the bombarded gas.

Reliable comprehensive experimental data on the angular and energy distributions of secondary electrons are required to understand the energy transfer processes in the upper atmosphere and to calculate the overall energy budget in the atmosphere. The long-term goal of the studies funded here is to develop complete and accurate sets of scattering cross-sections for electron impact on gases characteristic of planetary atmospheres. These cross-sections are necessary to understand the energy budget in these atmospheres. This grant funds this task for the gases N2, O2, NO, CO, CO2, H2, He, CH4, using a crossed-beam technique.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0034, A WIDEBAND INTERFEROMETER SPECTROMETER FOR IMAGING DAYGLOW

D.G. Torr, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Atmospheric & Oceanic Science, *Ann Arbor, Michigan* 48104 (ATM78-19256)

This grant funds upgrading construction in order to field a ground-based instrument that will advance the state of the art of spectroscopy as applied to upper atmospheric studies. A number of important atmospheric processes are manifested in very narrow emission lines which would not otherwise be measurable.

The principal objective of this proposal is to acquire a ground-based airglow facility capable of high resolution (0-01A) broad-band (4000A) spectroscopy. It is planned to upgrade the engineering model of the visible module of the Imaging Spectrometric Observatory built for flight in Spacelab I. The high resolution will be achieved by including a Fabry-Perot etalon in the field-of-view of the instrument.

The instrument will be used to study both the dayglow and nightglow from the ground. It will be possible to make measurements of many parameters including winds and temperatures over a complete diurnal cycle. The instrument will also be used to make simultaneous measurements of very weak emissions at high resolution. An atlas of weak emissions will be completed.

The data will permit study of the chemistry of several metastable species such as NO ion (A3 positive sigma u) and O2 ion (A4 pi u) which are largely obscured by N2 (A3 positive sigma u) bands at lower resolution. The instrument will also provide a database of parameters including the concentration and temperature of ionic and neutral constituents, as well as information on the solar EUV flux.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0035, OCEAN PREDICTION EXPERIMENT (OPEX)

S.A. Piacsek, U.S. Dept. of Defense, Navy, Naval Ocean Research & Development Activity, Naval Oceanographic Lab., *Bay St. Louis, Mississippi* 39529 (DN894403)

To develop scientifically valid ocean forecast models with operational utility. The models will be able to periodically incorporate observational data (including those from satellites), and execute on operational Navy computers. Their purpose is to provide regional and global ocean environmental information for acoustic and internal wave propagation models and air-sea exchange parameters to the atmospheric prediction model.

To solve numerically the equations of hydrodynamics and thermodynamics relevant to the scale of motion or ocean region considered. Particular emphasis will be placed on (a) coupling a limited-area model, accepting local data input to the large scale flow; (b) correct handling of vertical and sea-air exchange processes; (c) utilization of satellite-derived sea surface temperatures and wind stresses.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Ocean Research & Development Activity

5.0036, ANALYSIS AND PREDICTION OF SEVERE STORM ENVIRONMENT

R.A. Anthes, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Meteorology, *116 Deike Bldg., University Park, Pennsylvania* 16802 (DF056650; AFOSR-79-0125)

AF function - most AF weapons systems are affected by the numerous physical processes which constitute 'weather.' Space rocket launches are hindered by clouds, thunderstorms and winds; electro-optical weapons performance are degraded by clouds, haze or precipitation; airfield operations, air-to-air refueling, reconnaissance and other missions are also similarly degraded. Deficiency - numerical weather prediction models (NWP) do produce relatively accurate forecasts of large scale atmospheric circulations. These models do not yet, however, yield accurate forecasts of the 'weather' which affects the AF mission. Increases in model accuracy will only result from high density data input, finer mesh mesoscale models and greater sophistication in the representation of the small-scale and sub-grid scale processes associated with turbulence, sensible heat and the moisture budget. Objective - the goal is to use a state-of-the-art mesoscale model and library of unique fine-scale meteorological data to gain insight into the modeling of radiation, evaporation and boundary layer terrain and their effects on the model forecasts of outbreaks of severe storms in the American Southwest. The hypothesis is that regional scale processes create a situation favorable to the development of severe convective activity, i.e. the geography of the region permits the emergence of airstreams which produce a peculiar thermal stratification allowing a storage of energy to take place at low levels. When this air is transported to a location where the restraining lid is released in the presence of strong wind shears in the vertical, the instability is released in a violent upheaval. How work contributes - progress in NWP requires case studies to elucidate the roles of various physical processes and how to model them.

High resolution data sets will be developed and the period of 24-36 hours prior to the outbreak of severe convective activity will be modelled to isolate the effects of terrain, surface heating, and evaporation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0037, EXPERIMENTAL EVALUATION OF ANGULAR SCATTERING AND ABSORPTION PROPERTIES OF ICE CLOUDS AT 10.6 UM CO2 LASER LINE

K. Liou, Utah Higher Education System, University of Utah, School of Mines & Mineral Industry, Dept. of Meteorology, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DF056160; F49620-79-C-0198)

AF function - propagation of 10.6 micrometer radiation is of import to laser propagation studies on the AFWL airborne laser laboratory and the bomber defense program. A candidate space-based surveillance system includes the detection of the CO2 line of engine and rocket exhausts and radiation/energetics studies for meteorological prediction models requires simulation of the IR properties of ice clouds. Deficiency -modeling of the propagation of the visible spectrum through rain and simple ice clouds has progressed well. However, the increased absorption at IR wavelengths and the complex shapes and sizes of ice crystals has seriously retarded the theoretical understanding of the scattering and absorption due to ice crystals at these wavelengths. The 10.6 micrometer wavelength, which is the operating wavelength for numerous Air Force systems is on the edge of a strong absorption band. Internal absorption within ice crystals would, therefore, be expected to be of importance. Objective - to experimentally measure under controlled laboratory conditions the angular unpolarized scattering pattern and absorption properties of several simple ice crystal clouds using the 10.6 micrometer wavelength of the CO2 laser.

Clouds of ice crystals of known shape and sizes (50-100 mm) will be generated in an environmentally controlled chamber whose wall temperatures are controlled. Such artificial ice crystals should not display uniform orientations so anisotropic scattering due to crystal orientation effects can be avoided. A polar nephelometer will measure the angular scatter of 10.6 micrometer laser radiation while a power meter will monitor the attenuation of the beam. The laser beam will be chopped near 1 millisecond to control internal heating within the crystals.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0038, MARS - THE BOUNDARY PROBLEM BETWEEN THE HEAVILY CRATERED-LIGHTLY CRATERED TERRAINS

C.A. Baskerville, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Engineering Geology Branch, *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (9550-02655)

All necessary Viking and Mariner 9 imagery will be compiled. A reconnaissance photogeologic study will be conducted. All geomorphic features will be located that appear to have a relationship to the Mars dichotomy problem (the juxtaposition of a complex multi-unit highlands terrain and an apparently resurfaced simple plains area separated by an unusually high scarp). Additionally and generally, typical geomorphic forms from the various terrain subdivisions will be separated out for detailed description and possible classification. LANDSAT photos of comparable Earth geomorphic features obtained from EROS Data Center will be studied with their Mars counterparts for process determinations as well as preliminary slope stability comparisons for indications of geologic materials from which the feature is formed.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0039, EXTRA-TERRESTRIAL OXYGEN FUGACITIES

M. Sato, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (9710-01150)

The project is primarily responsible for determining oxygen fugacity values of lunar rocks, meteorites, and other planetary matter to provide basic data on the oxygen fugacities of rocks and minerals in the Solar System. On the basis of these data and other available information such as the behavior of volatile matters, we evaluate the causes and mechanisms of REDOX reactions that occurred during the formation of planetary bodies and magmatic activities.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0040, U.S. LINEAMENTS

W.D. Carter, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, EROS Program, *12201 Sunrise Valley Dr., Mail Stop 710, Reston, Virginia* 22092 (0-7030-24014)

Lineaments observed in small scale satellite images are, in most cases, the surface expression of fundamental geologic features (faults, fractures, and structural folds or warps) that may control geologic contacts and drainage systems. Visible; near-infrared, thermal infrared and radar images, obtained from orbital altitudes are being analyzed to determine their contributions, advantages and disadvantages to such research. Emphasis at the current time is a comparative studies of LANDSAT multispectral images and SEASAT synthetic aperture radar (SAR) images of the southwestern Great Plains and the central Rocky Mountain region.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office

5.0041, BLUE GLACIER PROJECT

E.R. LaChapelle, University of Washington, School of Arts & Sciences, Dept. of Atmospheric Sciences & Geophysics, *Seattle, Washington* 98105 (DPP79-02886)

Accurate mass balance and climate measurements will be reinitiated at the Blue Glacier, Washington, for a period of three years. Measurements of accumulation, ablation, and residual snow will be made during the summer and early autumn of each year, using equipment and facilities available for earlier studies. During the first year, a specific examination will be made of the 1977 snow layer through core samples and snowpits to ascertain the effects of that year's record drought.

Data obtained from these observations supplemented by 21 previous years of data, will be used to study the glacier's response to wide-ranging weather conditions. The data will also be used to establish relationships with a well-located low-level weather station to refine methods of indirect mass-balance determination. The data will also be used to test the ability of an orographic precipitation model to estimate the yearly quantitative precipitation amounts over a 20 plus-year period.

The reaction of this relatively high activity index glacier (LaChapelle, 1965) to unusually large weather perturbations can be quite useful in the study of glacial response to climatic change.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0042, CLOUD AND PRECIPITATION PARTICLE SIZE SPECTRA (15420-GS)

L.F. Radke, University of Washington, School of Arts & Sciences, Dept. of Atmospheric Sciences, *Seattle, Washington* 98105 (DA0G8929; DAAG29-79-G-0005)

To obtain measurements and relate liquid and solid particle size spectra in clouds and precipitation to the mesoscale structure of storms, the mechanism by which precipitation is produced, the effects of moisture supply, air motion and changes in the particle spectra produced by topography. Relevance: Many E-O weapon and communication systems are sensitive to attenuation by liquid and solid particles in clouds and precipitation. Liquid and solid particle size spectra also are important in rain and ice crystal erosion, icing of aircraft, and prediction of cloudiness and precipitation.

As a subtask of a larger cycles project, use airborne and ground-based instrumentation to measure size spectra of solid and liquid cloud and precipitation particles as they move from over the Pacific Ocean into Washington state. Combine these measurements with other simultaneous measurements and observations from satellites, two instrumented aircraft, four weather radar (two Doppler), serial radiosondes, and a dense network of precipitation rate-measuring gages to analyze cloud and precipitatio. nicrophysics.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, ASPT AIR-TO-AIR COMBAT SIMULATION SOFTWARE DEVELOPMENT
E.G. Monroe, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223870)

To increase the training capability of the advanced simulator for pilot training in the area of air-to-air combat. To accomplish this, the visual system will be improved to simulate the visual effect of cannon and rocket fire and the effects of sunglint and glare.

The existing ASPT software will be modified to generate a simplified additional moving model. The present system of software will be utilized to simulate cannon and rocket fire from the viewpoint aircraft. Program scoring algorithms for scoring pilot performance will be developed for display on a vector general. Finally hardware and software modifications to the ASPT system will be developed to simulate the visual effect of sun-glint off a lead aircraft and glare on the viewpoint windshield.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, ANALYSIS OF LONG BONE AND VERTEBRAL FAILURE PATTERNS
J. Eurell, State University System of Florida, University of Florida, Graduate School, *Gainesville, Florida* 32611 (DF057910; AFOSR-80-0130)

AF function - the Air Force operational environment involves exposure to a wide variety of mechanical forces which include flail and impact. These forces are of special significance in relation to the incidence of ejection from high performance aircraft where the probability of disabling injury is unacceptably high. In describing or attempting to protect aircrew members against compression, flail and windlbast injury, the failure responses of long bones and joints and vertebral centra are of critical interest. Deficiency - little effort in research to date has been directed toward characterizing the response of bone to deformation and fracture at the macroscopic and microscopic levels. Objective - the overall objective of this project is to provide fundamental information concerning bone deformation and fracture. The research will determine the microstructural characteristics and failure modes of operational injuries to bone. How research contributes - this work will provide essential information to assist in understanding strain rate dependency, fatigue, recovery, fracture pattern and hard tissue strength. It will contribute to subarea 1.7, 'Aircrew Safety and Effectiveness in Mechanical Force Environments'.

Scanning electron microscopy (SEM) will be used to characterize operational fracture patterns of long bones, and a correlation will be made between mechanical loading and failure modes. Computerized axial tomography will be employed to scan long bones and obtain additional information such as localized density which will be correlated with quantitative histochemistry. Normal morphologic and histochemical parameters of rhesus monkey, baboon, chimpanzee, marmoset, rat, and human vertebral centra will also be determined with SEM and quantitative histochemistry. These parameters will then be assessed in compressed vertebral centra and any variations from normal will be correlated with failure patterns. The study will then be expanded to include the effects of diseases such as Schmorl's nodes, spondylosis deformans, Scheuermann's disease, and scoliosis on the determined vertebral centra morphologic and histochemical parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0003, HUMAN OPERATOR CONTROL STRATEGY MODEL
J.L. Birchfield, Georgia Inst. of Technology, Engineering Experiment Station, *225 North Ave. N.W., Atlanta, Georgia* 30332 (DF228160; F33615-77-C-0042)

Develop and validate a model of human operator control strategy on perceptual/motor tasks such as flying and investigate relationships between control strategy and cue utilization, learning, and changes in task variables.

Identify human operator characteristics that ought to be considered, develop an operational definition of control strategy, conceptualize and implement a model based on a defendable theory-of-control strategy development and learning, and conduct extensive validation tests. Tom Longridge is co-monitor.

SUPPORTED BY U.S. Dept. of Defense, Human Resources Lab., Flying Training Div.

6.0004, THE ASSESSMENT OF OPERATOR WORKLOAD IN MAN-MACHINE SYSTEMS
C.D. Wickens, University of Illinois, Urbana Champaign Campus, School of Arts & Sciences, Dept. of Psychology, *Urbana, Illinois* 61801 (DN975572; N00014-79-C-0658)

This research investigates theory and methods for predicting dimensions of operator workload in operational environments based upon attributes of tasks, system control/display characteristics and human information processing modalities. This research addresses the need for a unifying conceptual framework to further our understanding of the factors affecting workload and for deriving more precise measurement techniques. These issues are fundamental to achieving advances in the allocation of functions in man-machine systems, in the effective use of new technologies and in the assessment of human performance capabilities.

Initial efforts are directed to the validation of the most promising models of workload and information processing, and focus on the stages and modalities of processing to determine their degree of independent as a function of both primary and secondary task characteristics. Tasks include manual tracking and dynamic system's monitoring as required in the control of high performance vehicles. subsequent modeling and experimentation will be conducted in order to: (a) investigate the effect of distributing the presentation of information across input modalities and employing selective coding techniques; (b) examine effects of response modality upon control performance level; (c) establish interrelationships among various workload measures (particularly the way in which these measures co-vary in response to task variation); and (d) establish guidelines for predicting interference patterns when tasks are combined.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

6.0005, HUMAN INTERACTIONS IN AIRCRAFT MISHAPS
K.W. Wegner, Boston College, Chestnut Hill Campus, School of Education, Dept. of Education, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DF054930; AFOSR-79-0102)

AF function - this research supports the Air Force Flying Training Program and the Air Force Safety Program, particularly the work at the Air Force Inspection and Safety Center. Deficiency - very rarely do aircraft accidents occur in the absence of some human interaction, even in single seat aircraft. There is almost always other people who interact with the pilot, either directly or indirectly influencing the events of a mishap. This interaction is poorly specified in accident reports, making it difficult to analyze the sequence of events that lead up to a mishap. Objective - the objective of this research is to study human interaction in USAF aircraft accidents and evaluate difference approaches for describing such interactions which will be useful for accident analysis and prevention. How research contributes - the results of this research will be a more thorough understanding of how various individuals interact with a pilot in an accident situation and how this interaction can be described. This information should impact applied research on aircrew training for emergency procedures and the technology of accident analyses.

The principal investigator will examine a sequence of events reporting system which would allow for interaction information in capsule form for easy retrieval from computerized accident data files. this reporting system would be based on a taxonomy of human error which would be the input tool for ac-

cident information. Research will determine if such a taxonomy can adequately represent all of the significant human interactions so that they can be reconstructed from a coded data file summary for meaningful analyses.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0006, EFFECTS OF SLEEP DEPRIVATION ON THE CENTRAL NERVOUS SYSTEM
A.K. Sinha, College of Medicine & Dentistry of New Jersey, Rutgers Medical School, School of Medicine, Dept. of Physiology, *Box 101, Piscataway, New Jersey* 08854 (DF051050; AFOSR-78-3532)

AF function - Air Force operations expose personnel to a wide range of physiological stresses including prolonged missions with altered work/rest cycles. Varying levels of fatigue and performance degradation may occur as a result of such conditions and thus could impact on the efficiency of aircrewmembers and support personnel. Deficiency - sleep loss and fatigue due to extended missions occur in many Air Force operations. Little is known about the cellular, subcellular, and molecular changes that occur during sleep deprivation. Objective - to detect and describe some of these changes in brain cells (cellular and subcellular) during sleep deprivation, to explore the possibility of reversing them (thereby reversing or minimizing the functional decrement) by chemical intervention and, to determine if qualitatively same biochemical changes take place during cyclic alterations between normal sleep and wakefulness. How research contributes - this research will provide essential information on the effects fo sleep deprivation on central nervous system integrity. Findings will serve as a data base to establish rest recovery procedures for flight crews/support personnel.

A variety of stressful situations is known to stimulate neuroprotease (lysosomal) activity. This generalization suggests that neuroprotease activity in brain will increase following sleep deprivation. A number of conditions (exercise, starvation, infection, hypoxia) and chemicals (progesterone, vitamin A, hyperbaric oxygen) are known to cause simultaneous increase in neuroprotease activity and sleeping time. Based on these observations this effort proposes the following working hypothesis. Prolonged wakefulness or sleep loss increases neuroprotease activity, which causes subcellular disorientation in brain cells and is behaviorally manifested in sleepiness and associated behavioral decrement. This hypothesis will be further tested by light- and electron-microscopic survey of morphological changes in brain cells due to prolong sleep loss. A number of chemical are known to stabilize or labilize lysosomal enzymes. It will be determined if lysosomal stabilizing drugs will prevent sleep rebound and morphological alterations following sleep loss. The time course and reversibility of structure changes will be delineated in animals. (Test Abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0007, PATHOLOGICAL MECHANISMS
A. Hall, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF315120)

To define the morphology and mechanisms of toxic injury at the cellular level.

To describe by light- and electron-microscopy and to document the pathologic change seen following toxic injury in experimental animals. To intergrate these changes with clinical chemistry and hematological changes, and then ultimately, to correlate these changes with cellular biochemistry. To perform morphometry on tissues and cells at the microscopic level. To determine the efficacy of drugs used for treatment of intoxication by evaluation of change in animal tissues and blood. To perform quality control on animals used in toxicity studies employing hydrazines and haloalkanes.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Toxic Hazards Div.

6.0008, PARAMETRIC ANALYSIS OF PHYSIOLOGIC DETERMINANTS IN PERFORMANCE/ACCELERATION
J.H. Veghte, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF326350)

This task is to 1. define the physiologic basis of performance changes associated with accelerative forces, 2. develop and evaluate workload, biodynamic and protection models of pilot performance, 3. devise methods of performance enhancement from these models, 4. establish parametric values of the human optimal control model in terms of visual information, observation and neuromuscular noise and the energetic stores, and 5. conceive and evaluate new analytic tools and methods that advance the understanding of the physiological basis of performance degradation during acceleration.

Efforts will be directed towards implementing experimental programs to validate the submodels delineating the effects of acceleration on performance and decision models. Initial studies will be concerned with describing the visual and other submodel transfer functions. The proprioceptor-muscular submodel will be described through romygraphy techniques. Data obtained to develop the biodynamic-physiological models will be used to further describe the perception and control output models. Supportive non-human primate studies will be used to obtain necessary invasive physiologic data for the development of the models.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Biodynamics & Bionics Div.

6.0009, ADVANCED LOW-COST G-SEAT (ALCOGS)
T.A. Dignus, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF229160)

To objectively determine - A. Drive algorithms which produce G-cuing that is highly correlated with the G-cuing environment of an actual aircraft. B. The minimum hardware requirements for effective G-cuing. C. techniques for validating existing experimentation in the area of motion and force cuing which apply directly to the ALCOGS.

Psychophysical experiments will be conducted in order to prioritize human sensitivity to various G-seat parameters. Pressure sensors along with video recording equipment will be installed on the G-seat and time history data collected for predetermined manuevers. This data along with the baseline sensitivity data will be used in conjunction with aircraft data in hand to achieve an objective correlation. Once objectively correlated algorithms have been designed, a tracking display will be installed on the ALCOGS. Baseline RMS error data will be collected for a predetermined task, and the various G-seat parameters systematically degraded until an optimum minimum requirement/performance point is reached. While in this process, the ALCOGS will also be used to test this new drive philosophy against existing motion and force experimental results and conclusions. Milestones - psychophysical experiments and analysis completed, Jun 79, comparison experiments and analysis completed, Jan 80, hardware requirements determine, Aug 81, algorithm refinement complete, Nov 81, research validation complete, Feb 81. Don McGuire is co-monitor.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0010, BIOMECHANICS OF COCKPIT EVALUATION
W. Hovey, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (DF317180; F33615-78-C-0507)

To improve USAF's capability to provide human engineering support to the design and evaluation of crewstations by automating the complex operator/machine interaction by means of a three-dimensional interactive graphics computer model. To automate the handling of body-size variability data to improve the utility of these data to guide the design of AF systems and equipment. To provide computer techniques for evaluating the effects of flight clothing on operator's interaction with the crewstation. To provide computer methods for sizing and design of personal-protective equipment.

The utility of the combiman (computerized biomechanical man-model) will be enhanced by the expansion of data bases for

clothing/personal-protective equipment and aircraft cockpits. Techniques for automated reach-task analysis will be improved. A technique for the elimination of hidden lines on the display will be developed. AMRL's force testing devices will be used to obtain male and female strength data for the design and placement of aircraft controls.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Human Engineering Div.

6.0011, DEVELOPMENT OF HUMAN FACTORS ENGINEERING DATA AND METHODS FOR ADVANCED AIRBORNE SYSTEMS, EXPLORATORY (BLOCK PROGRAM)
P.M. Curran, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN681086)

To develop and apply required data and effective methods to achieve effective integration of operators and maintainers with weapon systems to insure optimum performance of mission-related tasks throughout the entire life cycle of airborne systems.

This program involves four general task areas: (1) visual displays and manual controls, (2) data base for design criteria, (3) weapon systems design, and (4) technology application. The approach applicable to all task areas is (A) identify critical subtask areas, (B) identify availability and adequacy of relevant data and methods for: (1) projected goals and applications, (2) defining requirements, (3) implementation of requirements, and (4) evaluation of implementation, (C) determine deficiencies criticalness and solution likelihood, (D) conduct required exploratory development efforts, (E) conduct appropriate validation and/or feasibility demonstrations, and (F) either modify development approach or terminate effort of transition to advanced development.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Systems Command, Tech Admin.

6.0012, DECOMPRESSION HAZARDS IN AEROSPACE OPERATIONS
J.D. Adams, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322300)

This effort will develop more effective procedures for the prevention of decompression sickness during exposure to potential decompression hazards. A significant number of cases of decompression sickness occur each year in USAF and other aerospace operations. This suggests current procedures for its prevention are not optimally effective. In addition, unusual conditions have arisen where established denitrogenation schedules do not exist or are ineffective, such as flying after driving, minimum frequency of high altitude exposure, the impact of interruption in denitrogenation, differences between male and female denitrogenation rates and prebreathing with less than 100 percent oxygen for on-board oxygen generating systems. Past efforts of defining decompression hazards and establishing preventative measures, have used empirical and subjective testing of humans in altitude simulators with symptoms of decompression sickness being an endpoint. Recent advances in technology have provided the ability to use non-invasive methods to develop required preventative criteria. These new methods are not only more precise but involve less risk to human subjects and are lower in cost. This effort will be directed towards the development and use of these objective techniques to develop more optimal preventative measures in a wide variety of current aerospace decompression problems.

The value of non-invasive techniques to monitor the condition of human volunteers both during the prebreathing and the actual exposure phases of simulated high altitude missions will be tested. During the prebreathing phase, nitrogen washout will be monitored, and during the altitude exposure phase bubble formation will be studied. Human subjects will be tested by a non-invasive technique for monitoring and evaluating the state of denitrogenation under various aerospace operational profiles. Denitrogenation curves will be used to evaluate and establish oxygen prebreathing criteria for various missions including those employing 100 percent oxygen or gas mixtures from onboard oxygen generating system. Specific efforts will include establishment of minimum safe excusal period between repeated high altitude exposures, determination of whether 15-min or 30-min denitrogenation schedule should be used before physiologic training flights, evaluation of the effects of airbreathing interruption in denitrogenation, and determination of effects related to individual human characteristics.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0013, CONTAMINANT CHARACTERIZATION OF AIR FORCE OPERATION ENVIRONMENTS
J.P. Conkle, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF320850)

The efforts will provide baseline data for assessing the biomedical impact of Air Force aircraft operations, prior to the advent of regulatory restrictions. The information is required not only for assessing environmental impact but also for evaluating combustor design criteria, smoke suppression additives and engine operational cycles. The work is closely coupled and coordinated with on-going turbine engine emissions measurement at the AFWL and AFAPL.

Chemical characterization of the organic compounds present in turbine engine exhaust will be accomplished for both gaseous and particulate specie. Samples will be obtained from a variety of sources including AF and Navy operational engine test stands and the AFAPL single combustor test rig. Analysis will be performed by a coupled gas chromatograph-mass spectrometer-data system. Results will be screened by AMRL/TH for toxic hazard assessment. Prior progress in this effort has been documented under Workunit 7164-16-13. This new workunit implements new technology planning objective alignment as directed by HG Aerospace Medical Division.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0014, GLAUCOMA
T.J. Tredici, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF323020)

Glaucoma has long been recognized as an important cause of ophthalmologic morbidity and removal from flying status in USAF aircrew personnel. A concerted effort is made at base level to identify affected aircrew personnel early, based on elevated intraocular pressure. This is most practically performed by using the Schiotz tonometer. The use of this instrument is taught to all flight surgeons during their course of instruction at USAFSAM. Further, the use of tonometer as part of the base level follow-up program is the most important part of the USAF policy on glaucoma. The objective of this workunit is to evaluate criteria for diagnosis, to delineate factors or characteristics which identify the point in the disease process when therapy should be instituted, to evaluate therapeutic modalities for both efficacy of treatment in absence of visual side effects which would contraindicate the performance of further flying duties, and where possible, to identify factors which causally relate progression of the disease.

The approach will involve careful and detailed ophthalmologic evaluation of each individual patient, with both follow-up interval and decision to commence therapy to be determined on an individual basis. The extensive and changing knowledge in literature in this field, both military and civilian sources, will be utilized as well as the accumulated expertise of the ophthalmology branch, clinical sciences division, in follow-up and treatment of this disorder in aircrew personnel. The study will also include those patients with a diagnosis of glaucoma who are on therapy with epinephrine drops which is recognized as efficacious and accepted by the Surgeon General for chronic use while retaining flying status (AFR 160-12). Work under this unit was formerly conducted under 7755-09-05 and 7755-09-04.

SUPPORTED BY U.S. Dept. of Defense, School of Aerospace Medicine, Clinical Sciences Div.

6.0015, REITAN VALIDATION
R.D. Wheatley, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF321710)

The Halstead-Reitan neuropsychological test battery is a standardized set of subtests administered and scored by a technician. The psychology function, neuropsychiatry branch, has undertaken the design and fabrication of subtest equipment which will permit automated administration and scoring via computer. The objective of this effort is to establish normative data using the automated subtests that can then be used in diagnostic evaluation of aircrew by the Aeromedical Consultation Service. Preliminary work with this test confirmed that published standards or 'norms' for the general population were not completely valid in the highly select (aircrew) population. New standards will refine the definition of normal/abnormal performance in aircrew.

Subjects undergoing evaluation by the aeromedical consultation service who are free of suspected/diagnosed neuropsychiatric disorders will routinely receive the Halstead-Reitan neuropsychological test battery to establish standards for 'normal' subjects. First, this will require validation of the new automated subtests, and second, determination of normal ranges and statistical averages for USAF normal fliers, normal nonfliers, head-injured fliers and head-injured nonfliers. The results obtained via the new automated Reitan will be compared with the standard manual Reitan.

SUPPORTED BY U.S. Dept. of Defense, School of Aerospace Medicine, Clinical Sciences Div.

6.0016, NEUROPSYCHOLOGICAL SEQUELAE AND PATTERNS OF DEFICIT IN USAF AIRCREW MEMBERS WITH CLOSED HEAD INJURY
R.D. Wheatley, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF324320)

To establish base rates and a collection of descriptive data regarding neuropsychological, and other psychometric, sequelae and patterns of deficit in USAF aircrew with closed head injury.

Compares the psychometric test performances of 50 closed-head-injured aircrew with those of 50 non-head-injured matched aircrew controls. Objective neuropsychological, intellectual, and personality measures are used. Inter-group as well as individual comparisons will be carried out so that inferences derived from levels and patterns of performance can be developed.

SUPPORTED BY U.S. Dept. of Defense, School of Aerospace Medicine, Clinical Sciences Div.

6.0017, THE ROLE OF NEURAL REFLEXES IN THE CARDIOVASCULAR RESPONSES IN THE CONTROL OF THE CIRCULATION
V.S. Bishop, University of Texas, Health Science Center at San Antonio, Medical School, Dept. of Pharmacology, *7703 Floyd Curl Dr., San Antonio, Texas* 78284 (DF036860; AFOSR-78-3657)

AF function - the Air Force must perform its mission under conditions which expose personnel to a number of environmental and psychological stresses including temperature extremes, varying oxygen tensions, maneuvering forces, fatigue and prolonged flights across several time zones. The circulatory system is one of the physiological systems which early shows operator malfunction due to such stress. An indicator for predicting performance reliability of the individual under acceleration stress has long been sought. Deficiency - little is known about the role of the cardiopulmonary receptors in the moment-to-moment regulation of the circulation in response to acceleration stress. Objective - the overall objective of this research project is to determine the role of the autonomic nervous system in the regulation of the circulation in animals at rest and during stressful conditions such as plus Gz, hypovolemia, and myocardial ischemia. How research contributes - this effort should assist in developing an understanding of the basic mechanisms of response and adaptation to accelerative force stresses and contribute to needed data base for enhancement of operator performance and safety. This research supports subarea 1.5, Habitable Crew Environments in Air Force Operations.

It is proposed to thoroughly investigate compensation provided by neural reflexes during plus Gz acceleration stress using chronically instrumented animal subjects. During this year the research will determine (1) if arterial pressure can be better maintained by aortic baroreceptor alone as opposed to functional aortic and carotid sinus baroreceptors, (2) the role of vagal afferents on the cardiovascular response to plus Gz, and (3) influence of arterial baroreceptors and vagal afferents on the secretion of renin from the kidney and catecholamines from the adrenal medulla.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, EXPLORATORY RESEARCH IN INTEGRATED PROGRAMMABLE AUTOMATION
J. McCarthy, Stanford University, School of Humanities & Sciences, Dept. of Computer Science, *Stanford, California* 94305 (DAR78-15914)

The objectives of this grant are to equip robotic systems with advanced capabilities for inspection, computer vision tasks and sensory/motor control of manipulators, and to integrate these advanced capabilities through a Very High Level Computer Language for communicating with the robotic system. The Very High Level Language will understand instructions using ordinary industrial assembly terms, e.g., put the screw in the hole. The language will draw upon a computer-aided design (CAD) data base describing the work place and work pieces obtained from analytical geometric models of industrial parts. Vision and motion capabilities are important by themselves, but they must be locally integrated into systems when they are used to perform tasks. This work addresses the means of local integration. It is not concerned with overall factory integration, but with local integration of inspection, sensory control, and monitoring at the level of a few interconnected machines. The integrated local system communicates with vision, with motion control, with the production system, and with the user. It must understand how to speak to each. A common language that all understand is based on geometric parts models from a CAD data base. CAD parts models will be used to build a library for assembly and for advanced teaching-by-guiding in Very High Level Language for programmable automation. Stereo vision will be used in inspection tasks and computer vision, imbedded in an extension of Stanford's existing Verification Vision system. The use of CAD models and teaching-by-showing in three dimensions will be investigated for programming vision tasks. Self-calibration and continuous monitoring mechanisms will be included. Research in sensory/motor control will include a high level language for force control and cooperative control of two manipulators.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Applied Research

7.0002, AERONAUTICAL RESEARCH, TECH AREA IV-RESEARCH IN MATHEMATICS
I.C. Statler, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Aeromechanics Lab., *Moffett Field, California* 94035 (DA0C5004)

The objectives are to exploit and apply state-of-the-art mathematics in support of laboratory research efforts. To develop a technology base in numerical analysis and computational techniques and to advance mathematics in areas of rotary-wing fluid mechanics applicable to air-mobile R&D.

The approach consists of three major steps. (1) Maintain awareness of the development and disseminate state-of-the-art mathematics throughout the laboratory. (2) Exploit new techniques and methods for assimilating the results of complex, time-dependent computations for airmobile applications. (3) Conduct

research in various applied mathematical topics which are relevant to Army needs. These objectives will be achieved largely through joint participation with NASA making maximum use of the facilities and expertise available within NASA with respect to computational fluid dynamics.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Aeromechanics Lab.

7.0003, CONTROL AND COMMUNICATION SYSTEMS APPLICABLE TO THE DESIGN OF AEROSPACE SYSTEMS

A.V. Balakrishnan, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Mathematics, *405 Hilgard Ave., Los Angeles, California* 90024 (DF051350; AFOSR-78-3550)

AF function - design of advanced aircraft control systems. Deficiency - the unification of the separate efforts in structures, aerodynamics, stability and control and propulsion is needed in early design phases. Objective - the objectives of this research are the development of efficient computing algorithms for optimal trajectories based upon the epsilon techniques, the development of theory and techniques for determining stability derivatives of aircraft based on measurements in flight which include wind-gust effects and design of a stability augmentation system thereof and the development of a theory of flutter suppression windgust alleviation for flexible aircraft using distributed parametric models. How work contributes - success in these objectives would contribute to the design of high performance variable geometry aircraft control systems.

The transient response of a three-degree-of-freedom section in unsteady aerodynamics and the corresponding system weighting functions will be calculated. Optimal feedback control for flutter suppression, both infinite-dimensional and finite-dimensional will be developed. Optimal control for alleviating turbulence will also be examined. The development of an efficient algorithm for identifying aircraft stability parameters real time will be developed. The theory of non-linear stochastic partial differential equation used in comparing the difference in formulation and solution between the Wiener process model and the non-linear White noise model will be extended for bilinear systems. The development of the theory of control of uncertain systems will be continued.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0004, PARALLEL PROCESSING IMPACT OF MIMD COMPUTERS ON FLIGHT SIMULATION SOFTWARE

R.A. Schmidt, Denelcor Inc., *Denver, Colorado* (DF228830; F33615-79-C-0009)

Perform an analysis of real time flight simulator software to obtain data on the increase in speed that may be obtained by optimizing algorithms by applying those algorithms and then running the altered programs on an MIMD computer. Program preparation - 2 MAC, exercise parallel algorithms - 8 MAC, execute programs - 10 MAC, contract end -18 MAC. Alex Shaw is the co-monitor.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

7.0005, FIRST PASSAGE TIMES IN STOCHASTIC DIFFERENTIAL EQUATIONS AND APPLICATIONS TO MATHEMATICAL PHYSICS AND ENGINEERING

B.J. Matowsky, Northwestern University, Evanston Campus, Technological Inst., Dept. of Engineering Science & Applied Mathematics, *633 Clark St., Evanston, Illinois* 60201 (DF051910; AFOSR-78-3602)

AF function - improve the reliability of aerospace vehicle structures. Opportunity - an analysis technique newly developed by the author promises results in AF relevant reliability problems. Objective - new insight into control of reliability in physical structures. How work contributes - by suggestive examples exhibiting and quantifying relevant non-intuitive effects.

Matched asymptotics will be used to analyze problems in filtering of random signal from noisy measurements, dynamic snap through phenomena in elastic structures subjected to random forces, dynamical systems driven by random noise, construction of time hierarchies for times when the dynamical system prevails and times when diffusion phenomena prevail, and a stochastic model for the phenomena of fast electrons in laser plasmas. Boundary layer order of the above differs from previous results and there is no potential. An example is Dynkin's equation for the expected exit time from a domain containing a limit cycle of a stochastically driven van der Pol oscillator. Rigorous proof of these formal techniques has been attained in some cases and will continue to be pursued.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0006, NUMERICAL METHODS AND APPROXIMATION TECHNIQUES FOR FLUID DYNAMICS APPLICATIONS

G. Birkhoff, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Mathematics, *Cambridge Station, Cambridge, Massachusetts* 02138 (DN624163; N00014-75-C-0596)

The high-speed computer has provided Navy scientists and engineers with numerical answers to problems in fluid mechanics, structural mechanics, heat transfer, and nuclear reactor theory of such complexity as to be unsolvable a few years ago. The success of this contemporary work derives directly from research efforts of type supported herein, since before programming and computation can be started, the kinds of analysis represented here must be undertaken. Problems of particular naval significance which have given rise to these techniques come from lubrication theory, boundary layer theory from hydrodynamics and aerodynamics, and transport theory for nuclear reactors.

Research is done on a group of related mathematical problems derived from fluid mechanics. Since emphasis is placed on the development of numerical techniques for engineering contexts, there is considerable work done on approximation theory and error analysis for digital computing algorithms.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0007, NAVY VEHICLE DESIGN AND CONSTRUCTION - VISCOUS FLOWFIELDS AND AIRFRAME FORCES INDUCED BY TWO-DIMENSIONAL LIFT JETS IN GROUND EFFECT

W.W. Bower, McDonnell Douglas Corp., Research Laboratory, *P.O. Box 516, St. Louis, Missouri* 63166 (DN675330; N00014-76-C-0494)

Develop the numerical techniques for predicting viscous, turbulent flow produced by the operation of high performance lift-jet VTOL aircraft in ground effect. These techniques will provide fundamental information on jet entrainment, temperature and velocity decay, and ground jet growth. This information will permit accurate prediction of induced forces acting on the airframe which are required for propulsion system sizing and aircraft stability and control analysis.

The numerical technique developed in the previous phase of this investigation for steady, 2-D, compressible, turbulent, vectored and unvectored impinging jets from fuselage-like bodies will be extended to the imcompressible 3-D case. Two jet geometries will be considered. An isolated axisymmetric jet included to the impingement surface will be analyzed. In addition, the flow field interactions of two axisymmetric surface will be analyzed. In addition, the flow field interactions of two axisymmetric jets which impinge on a ground plane perpendicular to the jets will be computed. A one-equation turbulence model will be developed for 3-D flows. Results will be compared with data generated in a complimentary experiment being conducted at McDonnell Douglas Research Laboratories.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0008, KINETIC THEORY OF GASES AND MAGNETO-FLUID DYNAMICS AND THEIR APPLICATIONS
H. Grad, New York University, Washington Square & University College of Arts & Sciences, Dept. of Mathematics, *421 1st Ave., New York, New York* 10012 (DF041250; AFOSR-76-2881)

AF function - hardening aerospace vehicles. Opportunity - existing mathematical physics promises improved understanding of satellite environmental effects and their simulation. Objective - to explore new ideas in the areas of nonlinear partial differential equations and transport equations associated with the kinetic theory of gases and magneto-fluid dynamics. How work contributes - improved analysis of models designed to exhibit AF relevant effects may suggest methods of control.

At the borderline between particle and fluid, when charge, EM field and energy range combine to make nonlinear mathematical models necessary, a diversity of mathematical techniques is required. Examples are singular perturbation of spectra, bifurcation theory, pseudo differential operators, solitions, etc. Using these techniques, problems like the instabilities possibly limiting Shiva X-ray output, solar wind modeling and laser target interactions can be addressed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0009, OSU/REALISTIC TERRAIN MODEL
C.A. Csuri, Ohio State University Research Foundation, *1314 Kinnear Rd., Columbus, Ohio* 43212 (DN094005; N61339-80-C-0008)

Develop computer animation using a digital data base and computer image generation (CIG) algorithms to develop a terrain model of high visual complexity including environmental features such as trees, vegetation, roads, structures and buildings. Animation sequences will simulate a pilot's eye viewpoint of helicopter flight patterns at treetop altitudes. Color slides, still photographs and a video tape of the animation sequences will be produced as deliverables along with a final report describing the algorithms used and computer timing and data base statistics required to produce the animation.

The Ohio State University computer animation facility will be utilized to produce the data base and animation sequences. The data base and animation sequences should represent a new high with regards to visual complexity, detail and realism in the use of CIG technology.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Computer Systems Lab.

7.0010, MATHEMATICAL PROBLEMS IN FLUID DYNAMICS
C.L. Keller, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF136320)

Present design methods for aircraft and missiles have great difficulties to predict the behavior of airfoils in the transonic region. The work investigates theoretically problems of transonic aerodynamics. Sometimes special features, as the junction of sonic line and shock, are studied but most of the work is done with a view towards improving the methods for computing the whole flow pattern. The work includes the development of background knowledge, in particular partial differential equations. The investigations are directed towards improving the numerical techniques, as well as the physical understanding of the phenomena in transonic flow fields. Spinoffs of similar numerical techniques to problems in stress and strain of aircraft structures will be explored.

The problem is treated under two different points of view, namely the study of properties of the partial differential equation and of its solutions which may be the cause of computational difficulties, and the direct study of numerical approaches. In the first part the nature of the solutions of typical boundary value problems will be investigated, in the second part a specific numerical technique will be examined with a view towards determining how well it or certain variants are suited to overcome the typical obstacles encountered in transonic flows. Another effort in aerodynamics is the computation of incompressible flow over multielement airfoils by means of an integral equation method (combined with preliminary conformal mappings). A related effort in this area is the proof of the adiabatic theorem for partial differential equations in two independent variables. Integral equation methods for the solution of the elastic problem in solid mechanics will be studied and then extended to elastic plastic problems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

7.0011, CONTINUUM THEORIES OF DAMAGE
M.E. Gurtin, Carnegie Mellon University, Mellon College of Science, Dept. of Mathematics, *4400 5th Ave., Pittsburgh, Pennsylvania* 15213 (DF043720; AFOSR-76-3013)

AF function - advanced aerospace vehicles. Deficiency - present analytic methods to predict structural material degradation, fracture and failure, when advanced materials are subjected to the broad range of environmental conditions encountered by present and forecast aerospace vehicles, are inadequate. Objective - to develop new models (continuum theory based) which correctly replicate the dominant features of the actual damage process, and which are sufficiently tractable (analytically and computationally) to provide both increased insight into the damage process, and also provide a foundation upon which more accurate and precise models can be built. How work contributes - success will contribute to improved structural analysis and design tools, more realistic and economical specifications and standards, and reduced operational and maintenance costs.

Based on continuum theory incorporating a damage measure which reflects the history of load and deformation. Functional relationships are to be developed based on assessment of experimental data. A high order of theoretical, thermodynamical and mathematical rigor will be maintained.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0012, DISCRETIZATION AND SOLUTION TECHNIQUES FOR NAVIER-STOKES AND TRANSONIC FLOW PROBLEMS
R.A. Nicolaides, Carnegie Mellon University, Mellon College of Science, Dept. of Mathematics, *4400 5th Ave., Pittsburgh, Pennsylvania* 15213 (DF057600; AFOSR-80-0091)

AF function - design of aerospace and reentry vehicles. Deficiency - these design problems are hampered by the lack of effective and efficient computational techniques to solve the modeling equations. Objective - to investigate stable and accurate numerical techniques incorporating mixed finite element methods to solve those modeling problems involving linear systems of partial differential equations. How work contributes - the techniques to be developed may lead to more effective and stable numerical algorithms for solving the modeling equations in fluid dynamics.

Recently mixed finite element methods have been developed for the approximate solution of model problems involving linear systems of partial differential equations. One aspect of the proposed research is to develop, investigate and implement algorithms for the efficient solution of the linear and nonlinear algebraic problems resulting from the mixed finite element discretization of the partial differential equations. A second aspect of the proposed research is to apply these mixed methods to a series of physical problems, viz.,incompressible Navier-Stokes equations and subsonic-transonic potential flows. For each of these, computer programs will be written to test the mixed methods and to illustrate their implementation. Also, an effort will be made to obtain theoretical bounds for the errors of approximation and these bounds will be verified by the computer codes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0013, IMPROVED DATA MANAGEMENT SYSTEM
R.B. Philbrick, Bell Helicopter Textron, *Hwy. 183, P.O. Box 482, Fort Worth, Texas* 76101 (DA0E3867; DAAJ51 79 C 0015)

Develop an improved data analysis and management system known as DATA-MAP (data from aeromechanics' test and analytics - management and analysis package, formerly known as OLS-DMS) to be used for interactive analysis and display of

data resulting from flight, wind tunnel, or whirl tower tests, and for validation and evaluation of analytical methods. An end result will be the capacity to analyze and display data for improving performance, stability and control, loads and vibrations, acoustics and aeroelastic stability.

Improve DATA-MAP (OLS-DMS version 2.01) by expanding and enhancing its graphics, analysis and operational capabilities in order to increase its versatility and usefulness as an engineering tool. A data file will be defined to simplify conversion of data formats and structures for input to DATA-MAP, thus facilitating direct comparison of test and simulation results and also providing for C-81 data display and analysis.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

7.0014, NUMERICAL SOLUTIONS OF THE TIME DEPENDENT COMPRESSIBLE NAVIER-STOKES EQUATIONS

S. Abarbanel, Tel Aviv University, *155 Herzl St., Tel Aviv, Israel* (DF052850; AFOSR-78-3651)

AF function - aerospace vehicles. Opportunity - the design of future air force weapons systems will require fast and accurate solutions to complex compressible flow problems in such areas as aircraft-external weapons carriage effects, reentry flow dynamics, and flight at high angle of attack. Theoretical methods now available for analyzing such flow fields are either inadequate or excessively costly for engineering applications. Objective - to develop a variety of numerical-mathematical tools for solving the partial differential systems governing compressible (inviscid and viscous) flow and to apply them to problems of interest in aerodynamics. How work contributes - the research effort will develop numerical methods suitable for analysis of inviscid and viscous compressible flow fields, including the presence of shock waves. effort will be directed toward increasing the accuracy, reducing computational time, and increasing the generality of application of the methods developed relative to those currently available.

A finite method developed previously for solving inviscid, compressible flow problems will be extended to calculate the viscous flow for slender, blunted bodies at angle of attack. Also, a study of the stability of initial boundary value problems for the case of dissipative finite difference schemes suitable for application to aerodynamics problems and a study of the effect of boundary treatment on the stability of the overall scheme will be made. In addition, spectral methods based on Chebyshev polynomials will be used to investigate the problem of the interaction of a shock wave with a boundary layer.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, INVESTIGATION OF LASER ACTION IN MOLECULES WITH INDUCED DIPOLE AND WEAK DIPOLE MOMENTS (TMP162)

W.B. McKnight, University of Alabama in Huntsville, School of Science & Engineering, Dept. of Physics, *Huntsville, Alabama* 35807 (DA0G2520; DAAH01-80-C-0210)

Develop new high power laser concepts for future Army application. Experiments leading to lasers based on homonuclear diatomic molecules will be performed.

A theoretical investigation and analysis, numerical calculations, and experiment design and investigation on vibrational transitions in molecules having no intrinsic dipole moment or only a very weak one shall be carried out to develop an induced or weak dipole moment molecular laser. The case of molecules with induced dipole moments, in which an electric field is used to induce the dipole, shall be explored and calculations performed to establish operating conditions which will yield laser action. Calculations shall be based on H2. Stimulated emission cross-sections and inversion densities required for laser threshold shall be calculated. An experiment shall be defined to demonstrate feasibility of the induced dipole laser.

SUPPORTED BY U.S. Dept. of Defense, Missile Command, Directed Energy Directorate

8.0002, ANISOTROPIC AND ELECTRO-OPTICAL EFFECTS IN LIQUID CRYSTALS

J.D. Margerum, Hughes Aircraft Co., *3011 S. Malibu Canyon Rd., Malibu, California* 90265 (DF046390; F49620-77-C-0017)

AF function - the Air Force capabilities in flight operations relies on continuing advances in navigation, guidance, reconnaissance, and surveillance programs. Deficiency - there is a continuing need for new methods, techniques, and devices for the automatic capability in recognizing data patterns and new information. Objective - research is concerned with the chemical and physical structural effects of liquid crystalline components on the related electro-optical properties. How work contributes - results will contribute to the device work on liquid crystals projects on developing flat panel matrix displays for airplane cockpits, electronic reticles for fire control systems and screen projection displays.

The research is directed toward a better understanding of the anisotropic and electro-optical effects in liquid crystals (LC). Studies will be undertaken on the relationship between the flow viscosity of LC mixtures and their conductivity anisotropy, and their dynamic scattering (DS). The effects of chemical structure variation on the birefringence of LC mixture will be investigated, along with the relationship between birefringence of LC mixtures and their DS characteristics.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0003, ION BEAM PROPAGATION

R.R. Johnston, Science Applications Inc., *P.O. Box 10268, Palo Alto, California* 94303 (DN975378; N00014-79-C-0221)

The Navy needs quantitative information on the propagation of intense, high energy, low gamma, ion beams in resistive gaseous and plasma media. New sources for such beams are being currently developed. The need for such development hinges, in good part, on the ability of the ion beams thus produced to propagate over long distances in resistive and gaseous plasma media.

The propagation phenomena will be modeled in terms of the monopole and dipole plasma-electrodynamic interaction. A multi-fluid description will be incorporated in a computer simulation code LOGAP. Finite temperature and pressure will be included to establish realistic predictions on the longitudinal bunching instability.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0004, MAGNETOSPHERE-IONOSPHERE-ATMOSPHERE INTERACTIONS

R.A. Helliwell, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (ATM78-20967)

This grant supports the investigation of magnetosphere-ionosphere-atmosphere interactions for a two-year period. The approach to be used involves both theoretical and experimental work. In the experimental area, the primary source of data will be a field program of active and passive probing of the magnetosphere-ionosphere system at Siple, Antarctica, and Roberval, Quebec, Canada. In addition, analysis of correlative data from a number of other ground-based and satellite programs will be performed. Major scientific problems to be investigated include (1) wave-induced particle precipitation and its effects on the ionosphere, (2) the origin of VLF waves in the magnetosphere, with particular emphasis on the role of man-made VLF noise in stimulating wave activity in the magnetosphere, (3) longitudinal wave-particle interactions in the magnetosphere, and (4) sub-

storm electric fields in the plasmasphere and their effects on the ionospheric F region.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

8.0005, QUANTUM FLUIDS AND SOLIDS
A.L. Fetter, Stanford University, School of Humanities & Sciences, Dept. of Physics, *Stanford, California* 94305 (DMR78-25258)

The theoretical low-temperature research in this project will study liquid 3He. The investigation of the superfluid's internal structure will include the response and stability in the presence of hydrodynamic flow, the effect of confining walls, and the behavior when subjected to uniform rotation. In each case, the effect of a static magnetic field will be considered along with the utility of nuclear magnetic resonance as an experimental probe of these systems. The motion of ions in uniform liquid 3He will be analyzed in various regions of the phase diagram. This study will involve the linear behavior at low electric fields and also the nonlinear regime for both the normal fluid and the superfluid. In addition, the use of ions to study nonuniform textures in superfluid 3He will be investigated.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0006, RESEARCH IN THEORETICAL ELEMENTARY PHYSICS
L. Susskind, Stanford University, School of Humanities & Sciences, Dept. of Physics, *Stanford, California* 94305 (PHY78-26847)

Research will be done in theoretical physics to further our understanding of elementary particles, quantum field theory, and related areas of solid-state physics, statistical mechanics, astrophysics and cosmology. Topics include: 1) Quantum chromodynamics, focussing on questions related to quark confinement, 2) Quantum field theory in environments of extreme temperature, density, or pressure, 3) Elementary particle physics of the very early universe, and 4) Dynamical mechanisms for symmetry breaking-in theories of the electro-weak force.

This is the first year of a four-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0007, PVF2 TRANSDUCERS FOR NONDESTRUCTIVE EVALUATION OF CERAMICS AND BRITTLE MATERIALS
H.J. Shaw, Stanford University, W.W. Hansen Lab. for Physics, *Stanford, California* 94305 (DF049450; AFOSR-77-3386)

AF function - ceramic materials are being developed for a variety of components (e.g. blades, vanes, combustors, bearings and seals) in future gas turbine engines and for a variety of electronic and optical components in aircraft. Because ceramics and new brittle metal alloys fail catastrophically from pre-existing flaws or cracks, new nondestructive evaluation, NDE, techniques are required to locate and reject these defects. Opportunity - an important new material, polyvilidene fluoride (PVF2), has been found to have properties particularly suitable for operation as a high frequency ultrasonic transducer. Objective - this research seeks to understand and develop the utilization of PVF2 for application to NDE of ceramics and brittle metals. How work contributes - high frquency, and flexible geometry will allow flaw detection on complex geometries such as turbine blades.

This research will develop the theory, the optimum geometrical configuration and the design curves for PVF2, multilayer transducers. The desired insertion loss, bandwidth and acoustic beam shape will be optimized for the excitation of bulk and surface waves.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of
Scientific Research

8.0008, TRANSPORT AND ELECTRONIC PROPERTIES OF DISORDERED SOLIDS
M. Pollak, University of California, Riverside Campus, School of Physical Sciences, Dept. of Physics, *Riverside, California* 92502 (DMR78-21959)

Transport and electronic properties of disordered solids will be investigated in two fundamental areas: one, the existence of a Hall effect associated with the hopping conduction process, and the other, the role of interactions in the electronic and transport properties of disordered systems. The Hall effect is primarily an experimental effort to measure the dependence of the AC Hall effect on the various relevant parameters. Theoretical work on the DC Hall effect associated with hopping, a strictly quantum mechanical process of fundamental interest, will also be performed. The work on interaction effects include an experimental and a theoretical part. The experimental part is done with the impurity conduction system (p-Ge), both because such effects are believed to be pronounced and because it is possible to vary some important parameters; namely, the concentration and the size and shape of the wave function. The theoretical work involves mainly three problems: the Coulomb gap for one electron hopping excitations and its effect on transport, the role of multi-electron excitations in transport, and a new problem of collective delocalization. This is the first year of a three-year continuing grant.

Reference: DMR77-22500.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0009, THEORY OF ELECTRONS AND PHONONS AT SOLID INTERFACES
L.J. Sham, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (DMR80-18440)

Research previously supported by DMR7709595.

Theoretical research on the electronic structure of solid surfaces and interfaces will be carried out on two topics. The first is the study of the properties of electrons confined to the interface region between a semiconductor and an insulator. Of particular interest here are the energy band structure of the inversion layer of a narrow-gap III-V semiconductor, such as indium antimonide, the low density phase in a magnetic field of the inversion layer of silicon due to exchange and correlation effects, the valley coupling beyond the effective mass approximation, and the electron-phonon interaction. The second part consists of the development of a theory of spin relaxation of conduction electrons due to the scattering by a surface, and its variation due to the presence of an absorbate on the surface or due to the contact with another solid.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0010, MEASUREMENTS TO TEST FOR THE VARIABILITY OF THE SOLAR CONSTANT
D.G. Murcray, University of Denver, School of Arts & Sciences, Dept. of Physics, *2115 S. University Blvd., Denver, Colorado* 80210 (ATM79-03877)

Professor Murcray (University of Denver) has developed a high precision balloon-borne system for measuring the solar irradiance. With previous NSF support he has shown that the solar irradiance has possibly changed by as much as 0.4% between 1967/68 and 1978. This result is potentially very important to many research areas and, therefore, it is important to check it. This support will enable Dr. Murcray to conduct two balloon flights for just this reason.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

8.0011, ELECTRONICALLY INDUCED PHASE TRANSFORMATIONS

A.J. Freeman, Northwestern University, Evanston Campus, School of Arts & Sciences, Dept. of Physics, *633 Clark St., Evanston, Illinois* 60201 (DF042710; AFOSR-76-2948)

AF function - this proposed research primarily falls in the 2.3 and 2.1 research objectives, which deal with electromagnetic materials and the metal working fundamentals. Materials in use today are operating at or near their capacity as regards to stress, temperature and environment. It is necessary to prolong use of current systems and envision new ones which will have extreme reliability. The characterization of these new materials as well as understanding the fundamental properties which cause phase transformation constitute the scope of this research. Deficiency - electronic materials have become increasingly important for scientific research because of the great potential they have demonstrated for various technological applications. Electronically induced phase transitions which occur in many metals are a mixed blessing; at times they destroy some of the very properties important to these applications. The better understanding of transitions in these materials show promise of more economical devices accessible to a wide range of application. Objective - the objective will be to use novel theoretical techniques developed by the principal investigator to obtain detailed first-principle understanding of the behavior and characteristic properties of several important classes of materials (BCC to Omega phase transition metals and the formation of charge density waves in transition metal di-chalcogenides). Contribution - this research is a part of a comprehensive program to support the work in quantum physics of matter studying phase transitions in materials.

The approach to be taken in this proposal is to study the electronically driven instabilities of the conduction electrons in metals by investigating the divergencies in the generalized static electronic susceptibility. Fundamental studies of electronically driven phase transformations, e.g., spin density waves charge density waves, and structural phase transformations (which compete with the superconducting phase transition) are essential in order to obtain a better understanding of the interactions responsible for the transformations. Novel theoretical techniques developed by the principal investigator will be used to obtain a detailed first-principle understanding of the behavior and characteristic properties of several important classes of materials, including the transition metal dioxides, the transition metal dichalcogenides, etc. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0012, MOLECULAR RADIATION PHYSICS

M. Inokoti, U.S. Dept. of Energy, Argonne National Lab., *9700 S. Cass Ave., Argonne, Illinois* 60439 (005174 TICNO; 67100/000701)

The interaction of ionizing radiation with matter first generates a large variety of reactive species (often called initial products), which start a chain of chemical reactions that eventually lead to the net radiation effects including biological changes. This work aims at establishing the probabilities and mechanisms for the formation of the initial products. The resulting knowledge about the initial products is essential as a firm basis for kinetic analysis of radiation chemistry and biology. The specific areas of current study include the following: (1) experiments that use fast electrons to determine the generalized oxcillator strengths of molecules and that use slow electrons to determine total cross sections, secondary-electron energy distributions, and properties of resonances in electron-molecule collisions; (2) photoabsorption studies that determine the optical oscillator strengths and photoionization cross sections; (3) theoretical studies on a variety of topics that include oscillator-strength distributions, photoionization cross sections, electron-molecule collision cross sections, electron-degradation kinetics, as well as cross section for heavy-ion collisions with atoms; (4) theoretical studies on secondary-electron spectra; (5) photoelectron studies that measure partial photoionization cross sections, the internal vibronic structure of molecules, and the angular distribution of photoionization products; and (6) fluorescence studies (including spectroscopy, polarization, and angular distribution of emitted photons), which will elucidate the properties of excited molecules and their decay into various modes.

SUPPORTED BY U.S. Dept. of Energy, Office of Environment

8.0013, CENTRAL HELIUM LIQUEFIER R&D

J.R. Orr, U.S. Dept. of Energy, Fermi National Accelerator Lab., *P.O. Box 500, Batavia, Illinois* 60510 (006350 TICNO; CH-3000-406)

The Central Helium Liquefier (CHL) is intended primarily to supply liquid helium for cooling superconducting magnets. Those magnets will be used in the Energy Saver Ring and also in the beam lines and experimental areas. The CHL refrigerator will be supplemented with approximately 30 satellite refrigerators deployed around the site. The CHL will also provide additional refrigeration-related services including liquid storage, gas purification, liquid nitrogen for shield cooling, gas sampling systems, etc. In addition, the CHL is the intended site for the liquid helium pumping station to supply liquid helium flow to the transfer system. The design capacity of the CHL plant is 4000 l/hr of liquid helium. About 40 tons/day of liquid nitrogen will be needed for liquid helium production. During FY 1980, as in prior years, the budget and costs for the CHL identified as involving the operating classification of funds have been wholly assigned to the Sub-task Summary Accelerator R&D. During FY 1981 and FY 1982 it is planned to assign portions of the operating budget for the CHL to two other Sub-task Summaries, Accelerator Operations and Experimental Facilities Operations as well as to the Accelerator R&D Sub-task Summary. The two additional Sub-tasks incorporated into this WPAS submittal for that purpose are Task No. 02-a-3, Central Helium Liquifier Operations (203), and Task No. 02-b-8, Central Helium Liquifier Operations (308).

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research, Office of High Energy & Nuclear Physics

8.0014, GRAVITATIONAL PHYSICS AND RELATIVISTIC ASTROPHYSICS

S. Chandrasekhar, University of Chicago, School of Physical Sciences, Dept. of Nuclear Studies, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (PHY78-24275)

Research in theoretical gravitational physics currently supported under NSF grant PHY76-81102 AO1 will be continued. Among the topics to be investigated are.

CHANDRASEKHAR: 1. Metric perturbations of the Reissner-Nordstrum black holes; 2. Separation variables for the equations governing perturbations of the Kerr-Newman black hole.

GEROCH: 1. Stability of asymptotic simplicity; 2. Total angular momentum at null infinity; 3. Positive energy conjecture.

IPSER: 1. Distribution of stars around massive black holes; 2. Nonspherical star clusters in general relativity; 3. Nonaxisymmetric rotating fluids in gravitational equilibrium; 4. Stellar-dynamical processes in stellar systems; 5. Differentially rotating objects.

WALD: 1. S-matrix for particle production by gravitational fields; 2. Renormalization for quantum field theory in curved space-time; 3. Semiclassical approximation to quantum field theory; 4. Solutions to perturbation equations.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0015, THE STUDY OF STRUCTURE AND OF VIBRATIONAL AND ELECTRONIC EXCITATIONS OF INTERCALATED GRAPHITE 15903-P

S.A. Solin, University of Chicago, School of Physical Sciences, Dept. of Physics, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (DA0G9010; DAAG29-79-C-0029)

To develop a deeper understanding of the properties of intercalated graphite and other intercalated systems. Relevance: This research is directly relevant to the ongoing program on graphite intercalated systems that is being done at the Universi-

ty of Pennsylvania and MIT and it has direct relevance to questions related to high conductivity graphite intercalation compounds.

Pure stage donor and acceptor compounds will be prepared with compositions spanning a broad range between concentrated stage 1 to dilute stage 9 systems. Vibrational excitations will be studied primarily with Raman spectroscopic methods and with infrared spectroscopy in order to measure the modes of vibrations. From the analysis of the Raman data as a function of donor and acceptor compounds one may be able to answer fundamental questions about the degree of charge transfer and localization.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0016, DEEP IMPURITY LEVELS IN TERNARY SEMICONDUCTORS

J. Dow, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Physics, *106 Engineering Hall, Urbana, Illinois* 61801 (DN775630; N00014-77-C-0537)

Future Navy electronics systems will require improved and new semiconductor materials. Increased understanding of the role of impurities in these materials will result in better material control, cheaper materials and new electron device application.

The contractor will study photoluminescence from deep impurities in ternary III-V alloys in an effort to understand why particular impurities form deep levels, and to predict the energies, oscillator strengths, and activation energies of the observed liners.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0017, MAGNETIC IMPURITIES IN SUPERCONDUCTORS

D.M. Ginsberg, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (DMR79-07771)

An investigation of the effect of magnetic impurities (chromium, manganese, iron, cobalt and nickel) on the superconducting properties of several transition metal elements (vanadium, niobium and tantalum) will be initiated. The appropriate dilute alloys will be fabricated via electron-beam coevaporation onto an unheated substrate; the resulting films will be removed from the substrate and characterized by electron microscopy and diffraction as well as mass spectroscopy. Superconducting parameters to be measured include the transition temperature and upper critical magnetic field. Electron tunneling measurements will be used to derive the electron density of states. These data will provide a test of several theoretical concepts and theories regarding the effect of magnetic interactions on the microscopic parameters of the superconducting state.

This is the first year of a three-year continuing grant.

This work is an extension of work supported under DMR-7680159.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0018, ATOMIC EMISSION SPECTROSCOPY

K.L. Andrew, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (PHY79-08644)

Research in atomic physics will combine theoretical and experimental approaches to study the spectra of heavy atoms and compare it with the predictions of Slater-Condon theory. The new techniques of Fourier spectroscopy will be employed.

This research is a continuation of that previously supported under NSF grant PHY77-02087A01.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0019, INTERACTING FERMI SYSTEMS

A.W. Overhauser, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (DMR78-00545)

Research formerly supported by DMR74-03464.

Theoretical research will be carried-out with the objective of a deeper understanding of electron-electron interactions in solids. Several types of phenomena will be investigated, such as one-electron energy spectra, collective phase transformations, collective excitations and dynamic scattering phenomena.

Also, some types of physical properties which have been found experimentally to exhibit anomalous behavior will be studied. These include the unusual magnetoresistance of sodium and potassium, the unexpected dependence with magnetic field of acoustic wave generation in aluminum and potassium and the thermal resistance of potassium at high magnetic fields.

First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0020, INVESTIGATION OF MICROSCOPIC AND MACROSCOPIC PLASMA PROPERTIES WITH APPLICATION TO SPACE PLASMAS

G.R. Joyce, University of Iowa, School of Liberal Arts, Dept. of Physics & Astronomy, *Jessup Hall, Iowa City, Iowa* 52240 (ATM78-22487)

Because of the complicated interactions of charged particles, the equations that describe a plasma are necessarily complex and are difficult or impossible to solve exactly. This grant will support the application of numerical methods and analytical approximations to study the microscopic and macroscopic properties of space plasma systems. Specific areas to be studied include the following: the development and characteristics of potential double layers using two-dimensional numerical simulations; Langmuir turbulence and type III solar radio bursts; the formation of double layers in the magnetospheres of Earth and Jupiter and associated particle acceleration and radio emissions; and the structure of the outer Jovian magnetosphere including the distribution of cold plasma, the current sheet and the energetic particle acceleration.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0021, THEORETICAL ATOMIC PHYSICS OF STRONGLY CORRELATED SYSTEMS

C.D. Lin, Kansas State University, School of Arts & Sciences, Dept. of Physics, *Anderson Hall, Manhattan, Kansas* 66502 (004759 TICNO; KSU 1426)

The theoretical investigation in the proposed work consists of studying: (1) hyperspherical coordinate system in treating many-electron problems; (2) ionization and charge transfer in ion-atom collisions; and (3) spectroscopy of positive ions along an isoelectronic sequence. We hope to extend hyperspherical coordinates to investigate atomic structure and atomic collision processes in order to develop sound theoretical models for dealing with charge transfer and ionization problems in ion-atom collisions over a broad energy region. To investigate spectroscopy of positive ions, multi-channel quantum defect theory will be applied to analyze complicated spectra. The proposed work deals directly with basic atomic three-body problems. Theoretical models developed are expected to be applicable to understand the basic dynamics of few-body problems and to provide reliable methods for calculating needed atomic data in many areas of applications. We have made substantial progress in the last contract period in developing a procedure of generalizing analytical functions from the independent electron approximation to solutions in hyperspherical coordinates. These new functions permit us to make an interconnection between the traditional independent electron model to the collective approach of hyperspherical coordinates. Generalization of hyperspherical co-

ordinates to many-electron systems can be perceived in the near future.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research, Office of Basic Energy Sciences

8.0022, COMPREHENSIVE STUDIES OF BIRKELAND CURRENTS UTILIZING THE IMS DATA BASE

R.L. Carovillano, Boston College, Chestnut Hill Campus, School of Arts & Sciences, Dept. of Physics, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (ATM80-07028)

The primary emphasis of this grant is to make a coordinated study of field aligned currents (FAC) and associated effects, particularly ground magnetic variations at auroral and mid-latitude locations. The study will include data analysis and theory relating to the International Magnetospheric Study (IMS) data base. Principal data sources will be measurements made by the Triad and S3-2 satellites; ground based data from the IMS and Air Force Geophysical Laboratory (AFGL) magnetometer networks, and from other stations reporting to the World Data Center; photometric (keogram) and DMSP auroral measurements; and selected other data sources such as radar and kilometric radiation measurements. FAC represent the dominant coupling between the ionosphere and magnetosphere. The principal aims of this research are to identify and explore characteristics of FAC under a variety of magnetic conditions, and to establish correlations (hopefully also cause and effect relationships) of FAC with other physical variables and events.

The topics to be emphasized are: 1) orientation of the FAC sheets in the magnetosphere and associated ionospheric Hall currents; 2) correlations between FAC intensity and ionospheric currents; 3) some effort at identification of the FAC signature at the earth's surface; 4) development of morphological characteristics and correlations between FAC and auroral forms.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0023, ENERGETIC PARTICLES AND MAGNETIC ACTIVITY

P.M. Hagan, Emmanuel College, Graduate School, Dept. of Physics, *400 the Fenway, Boston, Massachusetts* 02115 (DF582660; F19628-79-C-0102)

AF function - communications, surveillance and navigation. Deficiency - lack of understanding of magnetosphere and inability to predict solar particle effects on atmospheric and ionospheric conditions. Objective - define the charged particle population and magnetic field configuration in the interplanetary medium and the Earth's magnetosphere developing models and characteristic indices.

Design, develop and fabricate hardware modifications for the AFGL magnetometer network interfacing hardware with system software and with the data processing programs to provide increased system reliability and ease of utilization. Design and fabricate hardware to measure energetic particle fluxes, to discriminate species and to perform energy analysis. Match instrumentation to available satellite rides performing integration and calibration as required. Analyze data returned or recovered emulsion packages and perform payload simulation studies to verify observed results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, - Geophysics Lab.

8.0024, LASER-PRODUCED PLASMAS AND RADIATION SOURCES

B. Lax, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF042150; F44620-76-C-0002)

AF function - operation of high altitudes vehicles in a post-nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand the fundamental understanding of interactions between laser beams and plasmas in the presence of strong magnetic fields. Deficiency - the aforementioned information for the design of advanced equipment is not available today. Its acquisition may be realized by a well planned theoretical and experimental research program. Objective - this program will study the interaction of ionization waves and the effect of a strong magnetic field upon the backscattering of CO2 laser radiation from a laser produced plasma. Contribution - this work is a part of a comprehensive program of plasma research for the development of an x-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beams), the development of space and ionospheric communications, and the development of countermeasures.

This project will investigate theoretically the following areas: a. Stimulated backscattering and nonlinear acoustic wave interactions with the electron cyclotron motion. A detailed and refined approach will be used to provide more diagnostic information on the laser induced plasma. b. Head-on collisions between laser-driven ionization fronts. The 300 Joule CO2 laser is powerful enough to heat sufficiently the plasma and produce unambiguous measurements of the electron temperature jump in the collision zone. The laser beam will be split in two parts and focused by identical Cassegrainian optical systems onto the ends of a gas target. c. Coherent nonlinear Raman scattering from plasmas. A theoretical investigation will be performed of the third order nonlinear susceptibility in a simple plasma in two cases. 1. Without a magnetic field. 2. With a magnetic field. For simplicity a collisionless plasma will be considered. They will study the properties of the nonlinear susceptibility and the resonances at the ion acoustic wave frequency and at the electron plasma frequency. These theoretical results will be used to guide the experimental program. In this project they are in close contact and cooperation with Profs. Ong and Duderstadt of Michigan (grant AFOSR 76-2904) who are doing theoretical work in this general area.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0025, STATISTICAL MECHANICS AND THE MANY-BODY PROBLEM

F.Y. Wu, Northeastern University, College of Arts & Sciences, Dept. of Physics, *360 Huntington Ave., Boston, Massachusetts* 02115 (DMR78-18808)

Research previously supported under DMR7620643.

The phenomena of order-disorder transition through the consideration of model systems in lattice statistics will be investigated. Specific problems proposed for study include the percolation process, the Ashkin-Teller and the Potts models, phase transition in HC, a two-layer Ising system, and exact renormalization group transformation for the Ising model. Emphases will be on exact and rigorous results, and the interrelationship between the various lattice models. In the many-body theory the off-diagonal matrix elements for inhomogeneous systems will be evaluated. The magnetic properties of a many-electron system will also be studied.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0026, EXPERIMENTAL NUCLEAR SCIENCE

F.D. Becchetti, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Physics, *Ann Arbor, Michigan* 48104 (PHY78-07754)

An experimental program to investigate clustering phenomena in nuclei with direct transfer reactions will be carried out at a number of accelerator facilities. These data will provide quantitative tests of current theoretical models of nuclear clustering. Related work involving nucleosynthesis and nuclear stability will also be done.

This work represents a continuation of that currently supported under Foundation grant PHY76-00287.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0027, INTERACTION OF RADIATION WITH MATTER

W. Brandt, New York University, Washington Square & University College of Arts & Sciences, Dept. of Physics, *421 1st Ave., New York, New York* 10012 (004923 TICNO; 5-259-619)

This work comprises several interrelated areas. Basically the project is concerned with the mechanisms of dissipation of energy in organic and inorganic materials. Using excited states as probes, the research in the following areas is being performed: (1) the interactions, (2) mechanisms of weight loss and photoemission of small organic particulates in controlled atmospheres, (3) interaction of air-pollutant polycyclic carcinogens with nucleic acids, (4) measurements of cross sections for K and L-shell ionization processes for heavy projectiles in the low velocity region, (5) experimental test of target dependence of the effective-charge theory for light projectiles, and (6) theoretical studies on the energy loss of swift particles in plasmas over a broad density and temperature range. A new technique for determining the mass and charge of small organic particles and aerosols based on a novel modification of a Millikan apparatus was devised. This technique is capable of determining nanogram changes in mass and the loss or gain of one single electronic charge. New spectroscopic methods were also developed for determining the conformations of polycyclic aromatic carcinogen-DNA complexes. Extensive measurements of K-shell ionization cross sections have been performed. The theory for K and L-shell ionization has been extended with inclusion of Coulomb deflections, polarization, relativistic and electron capture effects and compared with experiments. A statistical approach to vacancy production in ion-atom collisions has been developed. Electronic stopping power data from solids have been analyzed, under the aspects of a new developed projectile effective-charge theory.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

8.0028, ELECTRONIC AND MAGNETIC PROPERTIES OF SOLIDS AT LOW TEMPERATURES

S.J. Williamson, New York University, Washington Square & University College of Arts & Sciences, Dept. of Physics, *421 1st Ave., New York, New York* 10012 (DMR79-17401)

This is a continuation and extension of work supported under DMR-7602043. Magnetic susceptibility studies have revealed that aluminosilicate spin glasses containing cobalt or manganese ions exhibit a new magnetic state when the applied DC magnetic field is sufficiently weak. The intriguing characteristics of this state will be investigated through studies of the variation of magnetic properties over a wide range of field, temperature, and concentration of magnetic ions. Appropriate techniques will be developed to use a superconducting magnetometer in fields much weaker than 200 mOe and for temperatures down to at least 0.5K. Dynamical aspects of this state will be explored. Surveys of other spin glasses (e.g., CuMn, AuFe, etc.) will be carried out to determine whether different classes of spin glasses exhibit this state. A superconducting magnetometer will be explored to measure the change in magnetic susceptibility of the A-15 phase of the high temperature superconductors V-Si and Nb-Sn as uniaxial stress is applied. The deduced changes in the electronic density of states, elastic constant, and superconducting transition temperature will provide significant tests for band structure calculations and models.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0029, DEFECTS IN SEMICONDUCTORS

J.W. Corbett, State University of New York, Albany Campus, School of Arts & Sciences, Dept. of Physics, *1400 Washington Ave., Albany, New York* 12222 (DN123026; N00014-75-C-0919)

Studies of defects in semiconductors, defects produced by radiation or by ion implantation of foreign species are of great importance to a broad spectrum of Navy electronics systems. Radiation effects studies support nuclear radiation vulnerability programs and ion implantation studies support new material and electron device technology.

The investigator combines a variety of theoretical and experimental techniques for identifying defects in semiconductors and understanding their affect on material properties. EPR, ENDOR, transient capacitance, Rutherford backscattering, channeling, and optical measurement techniques are used. Current efforts include studies of hydrogen related defects in silicon, and studies of lithium, boron, and gold-related defects. Another problem area is the relationship of oxygen impurities and heat treatment on the defect nature of silicon. Recently, interest has risen on the problem of impurities related to dislocations and these will be studied. Studies will be made on nature of defects in laser annealed semiconductors.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0030, MATERIAL SUPPORT TECHNOLOGY - EXPERIMENTAL STUDIES OF COOPERATIVE PHENOMENA

R.D. Parks, University of Rochester, School of Arts & Sciences, Dept. of Physics & Astronomy, *260 Crittenden Blvd., Rochester, New York* 14627 (DN123455; N00014-80-C-0082)

This work supports Navy programs requiring sensitive command and control systems. Rapid change of physical properties near phase transitions suits certain materials for applications for thermal sensing, switching, sensitive surveillance, and information storage.

The contractor will study specific heat in iron-3-aluminum as a tool for understanding the problem of spin-glasses; alloy materials in which a microscopic number of spins are locked in random orientations below a characteristic temperature TF. When clustering effects are important the system is a micromagnet. Chemisorption near a ferromagnetic curie point will be a second item of investigation.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0031, PHASE TRANSITIONS IN INORGANIC SYSTEMS (17014-P)

E. Merzbacher, University of North Carolina, Chapel Hill Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Chapel Hill, North Carolina* 27514 (DA0G0516; DAAG29-79-D-1002)

To study phase transition in inorganic solids by measuring the electrical parameters as a function of temperature. Relevance: Dielectric and ferroelectric properties are useful for military device applications and the physical insight on some lattice instabilities will be explored by these techniques.

A variety of high dielectric materials will be temperature cycled and their dielectric properties will be tabulated as a function of temperature.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0032, CHARGE TRANSPORT IN POLYMERS (14424-P)

M. Silver, University of North Carolina, Chapel Hill Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Chapel Hill, North Carolina* 27514 (DA0F8924; DAAG29 77 G0081)

To study, experimentally and theoretically, charge transport in polymer films possessing very small carrier mobility. Relevance: The Army is entering into a time when major commitments will be made to the utilization of these 'active' polymer films (active in both the piezoelectric and pyroelectric sense), but the mechanism for these properties is still in deep dispute. This work is a necessary first step to clarify question of the mechanism so that long term stability may be forecast. The PVF sub 2 polymer film is being explored as a component in a present fuzing program.

Polymer films having small carrier mobilities will be investigated using time-of-flight techniques with field interruption and field reversal to control the time carriers spend in the material, and charge recombination will be studied as a function of

light intensity and applied field to gain further insight into the time dependence of the charge transport behavior.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0033, DISSOCIATIVE ATTACHMENT RATES IN LASER MEDIA

J.N. Bardsley, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (DN075129; N00014-80-C-0233)

The present program will develop techniques for determining cross sections and rates for processes involving electron-polar molecule collisions. These processes are important in the modeling of excimer lasers important in proposed naval communications and navigation systems.

A phenomonological analysis of the experimental dissociative attachment rates for E-HC1 collisions is being performed to determine the dependence of these rates on the vibrational and rotational state of the HC1 molecule.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0034, HIGH EFFICIENCY LASERS

M.A. Biondi, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (DN475353; N00014-76-C-0098)

The Navy requires improved high efficiency lasers for surveillance, communications and weaponry. The objective of this work is to investigate atomic and molecular processess associated with new lasers for producing laser action in the visible or near visible spectrum at high efficiency and high power.

Dissociative electron recombination involving metal-bearing molecular ions containing Hg and Tl are being studied to determine which have the appropriate curve crossings for rapid dissociative recombination. Two- and three-body ion-molecule reactions involving charge transfer, atom transfer, and association are being studied in systems involving Hg and Tl species. Three body reactions are being studied via Monte-Carlo techniques.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0035, PHYSICS OF ELECTRON PRODUCTION IN HIGH-VELOCITY ION-ATOM AND ION-SOLID COLLISIONS

I.A. Sellin, University of Tennessee, Knoxville Campus, School of Liberal Arts, Dept. of Physics & Astronomy, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (INT80-17922)

The award supports basic research in atomic physics between the Department of Physics and Astronomy, University of Tennessee, and the Institute for Nuclear Physics and the Institute for Theoretical Physics of the University of Frankfurt, FRG. This project takes place in the framework of the Cooperative Science Program between the National Science Foundation and the German Research Association (DFG).

The objective of this research is to investigate the atomic structure of heavy particles through their formation and destruction in collision with target atoms and molecules. In particular, the researchers will study the asymmetries in the forward electron production peak in high-velocity ion-atom and ion-solid collisions, and search for electron shock waves in solids using the unique facilities of the GSI-UNILAC accelerator facility at Darmstadt, West Germany. The experiments are expected to yield results that would improve scientific understanding of the fundamental structure and behavior of matter at the atomic and molecular level.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0036, THE METAL-NONMETAL TRANSITION IN LIQUID MIXTURES

J.C. Thompson, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (DMR78-21744)

The metallic state in disordered materials, both liquids and solids, can not be understood on the basis of present theories for crystalline systems. To reach an understanding of these systems, the metal-nonmetal transition must be understood. This is the goal of the present work.

Systems of present interest are solutions of an alkali metal in liquid ammonia, and liquid alloys of Group IIIA Metals with such chalcogens as tellurium. Four techniques are used: optical reflectance from 0.5 to 5.0 eV; conductivity and (electrodeless) Hall coefficient measurements; photoconductivity; and field effect. The last two are new methods for liquids. Densities of electron states as well as carrier densities, mobilities and lifetimes are determined as functions of composition and temperature. These are interpreted in terms of disorder, electron-electron interaction, structural defects, and chemical bonding.

This is a continuation of work supported by DMR76-84338. It is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0037, LOWER THERMOSPHERE WINDS

W.B. Hanson, University of Texas, Dallas Campus, School of Natural Science & Mathematics, Dept. of Physics, *P.O. Box 688, Richardson, Texas* 75080 (DF583600; F19628-79-C-0113)

AF function - airborne surveillance, target acquisition. deficiency - atmospheric density variations with time and space cannot be predicted with sufficient accuracy. Objective - direct measurement of neutral wind motions by satellite-borne accelerometers. Correlation of these results is made with other satellite data, including accelerometer density measurements, to develop improved atmospheric models. How research contributes - permits accurate determination of Air Force satellite ephemerides and development of accurate density forecasting techniques.

A satellite triaxial accelerometer system was flown on the atmosphere Explorer-C satellite. Atmospheric density measurements have been derived from the two axes oriented to see large components of the force due to air drag. The third accelerometer axis was always nearly perpendicular to the air drag direction. Forces due to atmospheric winds along this axis may be determined. Separation of wind data from other forces acting on this axis is required. The other forces include those due to vehicle dynamics, motions of other instruments on the satellite and a small component of air drag if the accelerometer axis is not exactly orthogonal to the drag vector. This study will determine the accuracy with which neutral winds can be measured as a function of satellite altitude.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

8.0038, TOPIC IN THE THEORY OF TRANSITION-METAL SURFACES AND APERIODIC MATERIALS

J.J. Rehr, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (DMR79-07238)

Research previously supported by DMR7682112. Aperiodic materials are those which lack the periodic translational symmetry that simplifies the theory of crystalline solids; these include solids with surfaces or impurities or disorder, etc. This research consists of three topics which deal with such systems from a local-environment viewpoint: (1) The theory of the Extended X-ray Absorption Fine Structure (EXAFS) deals with a new experimental technique for determining local atomic structure in aperiodic materials. Two factors which reduce EXAFS amplitudes in solids will be studied: the many-body 'shake-up' and 'shake-off' processes, and the Deby-Waller factor. These studies should improve the determination of coordination numbers and vibrational structure from EXAFS. (2) The second topic is a generalization of the recursion method, a recently developed theoretical technique for determining local electronic structure in aperiodic materials, permitting in addition, calculations of the electron density. An application calculation of the D-electron

contributions at noble and transition metal surfaces will be carried out. (3) A final topic is the theory of sub-monolayer helium films, physisorbed on rare gas overlayers. A new tight-binding theory which makes use of the recursion method to calculate the low-temperature thermodynamics of these quantum systems will be evaluated.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0039, INVESTIGATION OF LOW INTENSITY EMISSION LINES FROM THE INTERSTELLAR MEDIUM

F.L. Roesler, University of Wisconsin, Madison Campus, School of Natural Sciences, Dept. of Physics, *Agriculture Hall, Madison, Wisconsin* 53706 (AST79-08416)

The development of the 15-cm Fabry-Perot spectrometer and associated observing facility at the University of Wisconsin, Madison, has enabled us to carry out an intensive program of observations of extremely faint optical emission lines from the interstellar gas. The observations have provided important information about the distribution, temperature, ionization state, electron density, and filling factor for a widely distributed, ionized component of the interstellar medium as well as for more localized regions of ionization. The observations and data analysis will continue in more detail to study the diffuse emitting regions, including also faint filamentary structures which we have recently discovered. Furthermore, the spectral scope of our work will be extended into the infrared, where the Fabry-Perot spectrometer shows considerable promise for high resolution studies of infrared emission lines such as the quadrupole lines of H2 and the Brackett line of atomic hydrogen.

This is a continuation of AST-7707840AO1.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, THEORETICAL STUDIES OF INTERPLANETARY MAGNETIC FIELDS, TURBULENCES AND COSMIC RAYS

E.H. Levy, University of Arizona, School of Liberal Arts, Dept. of Planetary Sciences, *Tucson, Arizona* 85721 (ATM79-22018)

A significant part of the sun's influence on the Earth and the planets is exerted through the intermediary of the solar wind. In addition, general ideas about the behavior of astrophysical plasmas can be directly tested only in interplanetary space. For these reasons, solar-wind studies have relevance over wide areas of science.

This grant supports a theoretical study of a range of basic solar-wind properties and behaviors. In this program, the investigations undertaken will include a study of the large-scale morphology of the interplanetary magnetic field, with particular emphasis given to the effect of the field's structure on cosmic-ray propagation and anisotropies. Recent work involving computer simulations will be extended and completed to further elucidate the effects of drifts on cosmic-ray transport. In addition, a study of mechanisms of particle acceleration in the solar wind will be undertaken.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

10.0002, THEORETICAL ASTROPHYSICS RESEARCH

P. Goldreich, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (AST78-21453)

Investigations related to a variety of outstanding astrophysical problems will be pursued. These include the excitation of density waves in galaxies by the potential of a central bar, the evolution of satellite orbits due to resonant tides raised in circumplanetary disks, the dynamics of supersonic turbulence in molecular clouds, the relation between quasar absorption lines and the clustering of galaxies, and the origin of the Kirkwood gaps in the asteroid belt.

This is a continuation of work being done under AST-7624281A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0003, MODERN AND HISTORICAL ANALYSES OF THE SOLAR CONSTANT

R.J. Angione, California State University & Colleges, San Diego State University, School of Sciences, Dept. of Astronomy, *5402 College Ave., San Diego, California* 92115 (ATM77-07987)

This grant will support the continuation of a long-term program of analysis of data on variations in atmospheric constituents and the solar spectral energy output during the period 1902 to 1960, combined with modern ground-based observations.

Half of the effort will be devoted to accurate determination of the solar constant and spectral energy distribution using modern techniques of analysis on published results and archival data from the Smithsonian Institution's Solar Constant Observing Program. This program was operated for more than 50 years under the direction of Dr. C. G. Abbot, and is unparalleled among photometric programs in terms of accuracy and time-length of baseline. Analysis of these data represents a way of recovering accurate, quantitative information on variations in the solar energy output over long-term scales.

The second half of the effort will be devoted to the establishment and operation of a state-of-the-art solar constant observing station at Mt. Laguna Observatory in Southern California. This station will incorporate all of the methods proven useful in over fifty years of Smithsonian observations, as well as modern technical advances to provide highly accurate contemporary benchmark values for variations in atmospheric constituents and the solar constant. Experience gathered in the operation of this station will be used in interpretation of the Smithsonian data. Long-term operation of the station is planned in a manner that will keep the need for long-term support at an absolute minimum.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

10.0004, ORIGIN OF COMETS AND THE EVOLUTION OF THEIR ORBITS

E. Everhart, University of Denver, School of Arts & Sciences, Dept. of Physics, *2115 S. University Blvd., Denver, Colorado* 80210 (AST78-17513)

Support is to continue a study of the interaction of comets with the solar system using Monte Carlo methods. Besides planetary perturbations, which change the total energies of the comets, the impulses caused by passing stars will also be included for these can make large changes in the perihelia of comets. In comparing the distributions generated by a realistic model with the distributions for real comets, one can get information about dissipation and observational selection effects. Thus, one can find numerical values for the average probability that a comet will be observed on various returns. Another part of the study is to investigate the past and future orbits for a few well-known objects, such as Chiron, a small body with a perihelion at 8.4 times the Earth's distance from the sun, recently discovered by Kowal. In particular, calculations will be carried out to find out if Chiron is in a stable libration orbit, or whether it is in an orbit which is chaotic or random in character.

Prior support was by NSF grant AST 76-18891.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0005, SOLAR PHYSICS
G.E. Brueckner, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN920046)

A capability is needed to forecast increases in solar short wavelength radiation (solar flares) and in solar particle emission, since these produce ionospheric and geomagnetic disturbances which adversely affect radio communication, over-the-horizon radar, guidance-control, and detection.

A new version of the high resolution telescope and spectrograph (HRTS) rocket instrument is being designed. Conversion of the old instrument for flight on Spacelab-2 is underway.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

10.0006, SPACE RESEARCH TECHNOLOGY
M. Daehler, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN320221)

To develop and construct demonstration devices of value to the Navy and DOD based on technology developed for the rocket program, e.g., IR, visible and UV surveillance sensors based on image converters and solid-state arrays used in space astronomy. To develop devices needed for the NRL rocket and satellite program, position determining X-ray sensors, band sensitive optical detectors, thick film electronic packaging techniques and counter-shift register circuitry, telemetry decoding systems and computer data interfaces.

Image converter designs developed in the far UV astronomy program are adapted to other spectral bands. Imaging techniques are developed for X-rays. Spectral modulation sensor systems are developed to detect line radiation sources against continuum background in IR.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

10.0007, SOLAR ATMOSPHERIC DYNAMICS
R.F. Stein, Michigan State University, School of Natural Sciences, Dept. of Astronomy & Astrophysics, *243 Natural Resources Bldg., East Lansing, Michigan* 48824 (DF248840; F19628-77-C-0068)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate solar disturbance predictions. Objective - to determine the energy transport mechanisms operating that heat the solar corona and drive the solar wind. How research contributes - provides information on which solar functions, such as oscillations, give rise to coronal and solar wind flows.

Calculate the driving of the solar atmospheric (300 second) oscillation resulting from thermal overstability of acoustic and magnetic modes in the super-adiabatic convection zone and the propagation, refraction and dissipation of these oscillations in the solar corona. Such results can then be used to determine what photospheric oscillation configurations give rise to the solar wind.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

10.0008, APPLICATION OF REVISED MK SPECTRAL TYPES TO GROUPS OF LATE-TYPE STARS
P.C. Keenan, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Astronomy, *164 W. 17th Ave., Columbus, Ohio* 43210 (AST80-05377)

The data in the Catalogue of Revised Morgan-Keenan Spectral Types of G, K and M Stars (Keenan and Pitts, 1980) will be used to examine the following three problems: 1. The luminosities of giant stars, bright giant stars, and subgiant stars. 2. The classification of the BY Draconis variables. 3. The determination of the spectral type at which giant stars develop rapid mass loss.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N81-20005* National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY, SUPPLEMENT 132
Feb. 1981 112 p
(NASA-SP-7037(132)) Avail: NTIS HC $5.00 CSCL 01A

This bibliography lists 342 reports, articles, and other documents introduced into the NASA Scientific and Technical Information System in January 1981. Author

N81-20006*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DESIGN OF A FUEL-EFFICIENT GUIDANCE SYSTEM FOR A STOL AIRCRAFT
John D. McLean and Heinz Erzberger Mar. 1981 65 p refs (NASA-TM-81256; A-8427) Avail: NTIS HC A04/MF A01 CSCL 01A

In the predictive mode, the system synthesizes a horizontal path from an initial aircraft position and heading to a desired final position and heading and then synthesizes a fuel-efficient speed-altitude profile along the path. In the track mode, the synthesized trajectory is reconstructed and tracked automatically. An analytical basis for the design of the system is presented and a description of the airborne computer implementation is given. A detailed discussion of the software, which should be helpful to those who use the actual software developed for these tests, is also provided. T.M.

N81-20007# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
ON CONTRIBUTIONS TO THE 10TH SYMPOSIUM ON AIRCRAFT INTEGRATED DATA SYSTEMS (AIDS)
Jun. 1980 372 p refs Partly in GERMAN and ENGLISH Presented at Aachen, 26-27 Mar. 1980
(DFVLR-Mitt-80-09) Avail: NTIS HC A16/MF A01

The different problems associated with the use of aircraft integrated data systems (AIDS) are discussed. The AIDS systems are used for maintenance and recording purposes of flight and aircraft condition. They help to improve reliability and economy of aircraft operation. Topics cover the use of AIDS data in determing wind shear during flight, AIDS DATA and air traffic control systems, and other AIDS data processing applications. For individual titles, see N81-20008 through N81-20021.

N81-20008# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Flugmechanik und Flugreglung.
FLIGHT DATA RECORDING AND DATA PROCESSING FOR LIGHT AIRPLANES AND GLIDERS c05
J. W. Siefert *In* DFVLR On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 9-33 In GERMAN; ENGLISH summary (For primary document see N81-20007 11-01)
Avail: NTIS HC A16/MF A01

A flight data recording and processing system is described, emphasizing the importance of the proper selection of transducers. The processing system includes modular processing programs for the time histories of the flight mechanical state and control variables as well as their subsequent processing. Programs for the three dimensional presentation bf flight paths and for flight performance graphs are also applied to this data structure. For the evaluation of flight tests, a simulation program was developed. With this system pre and post simulations can be performed. Results of performance, stability, and control measurements are shown. Author (ESA)

N81-20009# Technische Universitaet, Brunswick (West Germany). Lehrstuhl fuer Flugmechanik.
DIGITAL FILTERING OF PCM-RECORDED FLIGHT DATA FOR WIND-PROCESSING c47
M. Swolinsky and P. Voersmann *In* DFVLR On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 35-64 refs In GERMAN; ENGLISH summary (For primary document see N81-20007 11-01)
Avail: NTIS HC A16/MF A01

During the test phase of the SETAC microwave landing system, flight tests were performed for wind determination along the flight path. All required parameters were recorded on board by a PCM-flight data acquisition system in digital form. The evaluation of the recorded flight data on a digital computer shows that some signals contain disturbances which result from the sensor dynamics. Futhermore, the computed wind vector components show digital noise due to numerical differentation. It is demonstrated by using the angle of attack signal and the computed ground speed as an example that the disturbances can be eliminated with the help of digital filtering techniques which permit a more precise wind determination. In addition, digital filtering to separate the high frequency gusts from the low frequency wind shear is shown. Author (ESA)

N81-20010# National Aerospace Lab., Amsterdam (Netherlands).
ON THE USE OF AIDS-DATA FOR A STATISTICAL ANALYSIS OF WIND SHEAR DURING THE APPROACH c47
H. Haverdings *In* DFVLR On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 65-94 refs (For primary document see N81-20007 11-01)
Avail: NTIS HC A16/MF A01

Wind shear data, derived from the airborne integrated data system (AIDS) data measured on board 20 widebody aircraft during a period of one year, were subjected to a statistical analysis in order to obtain a better insight into the frequency of concurrence and the magnitude of wind shear on a worldwide scale. Only the horizontal longitudinal wind component (along the approach direction) was analyzed. The results pertinent to Schiphol Airport show that the frequency of concurrence is independent of height above the ground, except at ground to 40 m altitude where ground effect is noticeable. Comparison with statistical results from a wind tower shows the AIDS-derived method to be equally well suited for wind shear investigations. Author (ESA)

N81-20011# Technische Universitaet, Brunswick (West Germany). Lehrstuhl fuer Flugmechanik.
WIND SHEAR MEASURING ON BOARD AN AIRLINER **c47**
P. Krauspe *In* DFVLR On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 95-119 refs In GERMAN; ENGLISH summary Sponsored by Deutsche Forschungsgemeinschaft (DFG) (For primary document see N81-20007 11-01)
Avail: NTIS HC A16/MF A01

A measurement technique which continuously determines the wind vector on board an airliner during takeoff and landing is introduced. Its implementation is intended to deliver sufficient statistical background concerning low frequency wind changes in the atmospheric boundary layer as well as extended knowledge about deterministic wind shear modeling. The wind measurement scheme is described and the adaptation of apparatus onboard an A300 airbus is shown. Preliminary measurements made during level flight demonstrate the validity of the method. Author (ESA)

N81-20012# British Airways, Middlesex (England).
A SHORT NOTE ON AIDS AND WINDSHEAR: BRITISH AIRWAYS EXPERIENCE **c06**
A. Fisher and C. A. Vassie *In* DFVLR On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 121-134 refs (For primary document see N81-20007 11-01)
Avail: NTIS HC A16/MF A01

A two pointer vertical speed indicator was developed as an aid in assessing wind shear. The instrument indicates aircraft energy rate, or power controlling speed or height. The relation of energy rate to wind shear is shown. A flight simulator test incorporating the instrument was conducted using 19 test pilots. All pilots expressed enthusiasm for the device. Its role as a warning device for the onset of wind shear is evidenced empirically by a reduction in response time. Author (ESA)

N81-20013# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
INDIVIDUAL JET ENGINE STRESS LOAD MONITORING WITH THE AID OF THE FLIGHT DATA RECORDING SYSTEM LEADS 200 **c06**
J. Knittel and B. Mueller *In* DFVLR On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 135-151 In GERMAN; ENGLISH summary (For primary document see N81-20007 11-01)
Avail: NTIS HC A16/MF A01

A long term counting of stress cycles for a J 79-J1 K engine of a F-104 G was performed using the flight data recording system LEADS 200. Comparison of number of accumulated cycles as a function of engine running time shows remarkable differences between individual engines at a fixed engine run time, i.e., at engine overhaul interval, due to the different operation of each aircraft. Results indicate that at least a partial on-condition maintenance program depending on engine stress counting promises a realistic cost saving for combat aircraft.Author (ESA)

N81-20014# Technische Hochschule, Aachen (West Germany). Inst. fuer Strahlantriebe und Turboarbeitsmaschinen.
IDENTIFICATION OF JET ENGINE DAMAGES BY ENGINE TREND ANALYSIS LEADS 200 DATA **c07**
W. Koschel *In* DFVLR On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 153-181 refs In GERMAN; ENGLISH summary (For primary document see N81-20007 11-01)
Avail: NTIS HC A16/MF A01

The flight data recording system LEADS 200 is used for maintenance support and trouble shooting of military aircraft. A main part of the monitoring system LEADS 200 consists of the engine parameter trend analysis. By this the long term behavior of the engine can be observed. It can also be used for the identification of damage. Given the component characteristics as a basis it is possible to predetermine the effects of damage on the engine operation and on the deviation of engine trend parameters. Some examples of jet engine damage and identification by engine trend analysis are discussed. Author (ESA)

N81-20015# Technische Hochschule, Aachen (West Germany). Lehrstuhl fuer Strahlantriebe und Turboarbeitsmaschinen.
SOME EFFECTS OF COMPRESSOR FOULING ON THE BEHAVIOR OF A TURBOJET ENGINE **c07**
H. Toenskoetter *In* DFVLR On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 183-218 refs In GERMAN; ENGLISH summary (For primary document see N81-20007 11-01)
Avail: NTIS HC A16/MF A01

Difficulties in the identification of compressor faults by an engine condition monitoring system are discussed. For the example of compressor fouling, simulated on a single spool turbojet engine with a seven stage axial flow compressor, the effects on compressor characteristics (mass flow, pressure ratio, and efficiency) and on additional parameters that are significant for engine condition monitoring are presented. The influence on the behavior of the compressor stages and on the surge line is described. Experimental results are compared with calculated parameter changes showing satisfactory agreement for compressor fouling. Cleaning and surge line determination methods are shown. Author (ESA)

N81-20016# British Airways, Middlesex (England).
USES OF AIDS DATA IN AIRLINES ENGINE MAINTENANCE **c07**
E. R. White *In* DFVLR On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 219-234 (For primary document see N81-20007 11-01)
Avail: NTIS HC A16/MF A01

The use of aircraft integrated data systems (AIDS) for assisting in engine maintenance scheduling is discussed. Four examples are cited: (1) determination of the failure rate for the engine starter on the trident; (2) analysis of excessive turbine gas temperature on takeoff for particular engines; (3) investigation of Boeing 747 deceleration surging; and (4) Tri-Star and Boeing 747 N2 monitoring. Each problem is detailed and AIDS data pertinence is shown. Author (ESA)

N81-20017# Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany).
THE A310 AIRCRAFT INTEGRATED DATA SYSTEM (AIDS) **c06**
H. Kalbe *In* DFVLR On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 235-262 refs (For primary document see N81-20007 11-01)
Avail: NTIS HC A16/MF A01

The requirements of an AIDS for the A310 are identified. Based on the ARINC specification No. 717 for a new generation of equipment for airborne data acquisition and recording, different AIDS architectures are examined. The selected system for the A310 is presented in detail. Its modular architecture, functions, flexibility and extension possibilities are discussed. As an example of the performance capability of the A310 AIDS, the onboard data processing principle for engine condition monitoring is demonstrated. Author (ESA)

N81-20018# Eurocontrol Agency, Brussels (Belgium).
POSSIBLE ONLINE USES OF AIDS DATA IN FUTURE ATC SYSTEMS **c04**
M. E. Cox *In* DFVLR On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 263-291 refs (For primary document see N81-20007 11-01)
Avail: NTIS HC A16/MF A01

The feasibility of exploiting aircraft integrated data systems (AIDS) data in real time or near real time for air traffic control (ATC) related purposes is discussed. How the transfer of data can be carried out by a two way air/ground digital data link and the interface to accept AIDS data outputs are described. Possible ATC applications for AIDS data include meteorological forecasting, radar tracking, and maneuver detection. Probable future requirements for onboard AIDS are considered for civil and military aircraft. Some preliminary results obtained with an experimental AIDS data link transponder interface onboard Tristars are reported. Author (ESA)

N81-20019# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
EXPERIENCES WITH FLIGHT RECORDERS OBTAINED BY ANALYZING AIRCRAFT ACCIDENTS **c03**
O. Weber and G. Rosenau *In its* On Contrib. to 10th Symp. on

Aircraft Integrated Data Systems Jun. 1980 p 293-321 refs In GERMAN; ENGLISH summary (For primary document see N81-20007 11-01)
Avail: NTIS HC A16/MF A01

The readings of old fashioned flight recorders after a takeoff accident in Africa and two midair collisions within German airspace were analyzed. The possibilities and limitations of the recorded data were treated in detail with regard to the reconstruction of the sequence of events and the performance of the aircraft. Flight data determined by means of a digital flight recorder during takeoff and climb of a three engine jet were similarly analyzed in order to verify whether better results can be obtained by using more advanced integrated data systems. The superiority of the digital technique is shown. Author (ESA)

N81-20020# National Transportation Safety Board, Washington, D. C. Bureau of Technology.
A TECHNIQUE FOR RECOVERING NONSYNCHRONIZED DATA FROM A DIGITAL FLIGHT DATA RECORDER c35
Carol A. Roberts *In* DFVLR On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 323-351 refs (For primary document see N81-20007 11-01)
Avail: NTIS HC A16/MF A01

How critical data in out-of-synch areas of a digital flight data recorder tape can be recovered using a serial binary technique called BITDUMP is explained. Digital flight data recorder data recovery depends on the acquisition of a synchronization word once every second. Critical synchronization timing is interrupted if tape motion becomes unsteady or if the tape breaks on impact in an aircraft accident. Several cases where synchronization of critical data was lost because of tape breakage, as in the American Airlines DC-10 accident at Chicago, Illinois, on May 25, 1979 and the Air New Zealand DC-10 accident in Antarctica on 28 November 1979 are cited. The American Airlines DC-10 accident is analyzed in detail to demonstrate BITDUMP application. Author (ESA)

N81-20021# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
A QUICK-LOOK SYSTEM FOR THE PROCESSING OF FLIGHT DATA RECORDINGS c61
G.-J. Barth *In its* On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 353-371 refs In GERMAN; ENGLISH summary (For primary document see N81-20007 11-01)
Avail: NTIS HC A16/MF A01

A data reduction system which facilitates the routine inspection of digital flight recorder data is described. A PCM bit synchronizer detects and regenerates magnetic tape signals, the pulses of which are strongly distorted. The device outputs NRZ data and a phase adapted clock signal. A connected frame synchronizer is able to process alternating synchwords and locks to the begining of the frame sequence. In connection with a desk top computer, eight different flight data channels can be decommutated, recorded on a strip chart recorder, and displayed as bargraphs on the computer integrated TV screen. A 12 bit parallel TTL compatible interface to a computer allows for user implemented analysis. Author (ESA)

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N81-20022 Rutgers - The State Univ., New Brunswick, N. J.
A STUDY OF DISPERSION PROCESSES AND CLIMATOLOGY FROM THE TWERL BALLOON EXPERIMENT Ph.D. Thesis
Joseph Er-EL 1980 178 p
Avail: Univ. Microfilms Order No. 8105000

The TWERLE Balloon trajectories are analyzed for particle dispersion and climatology in the 150-mb level of the southern hemisphere and scales of 50 - 10000 km. Mean velocities and turbulent energy distributions were obtained by a Quasi-Eulerian mode of analysis and were used as a frame of reference for single-particle dispersion statistics. The zonal anisotropical nature of the flow affects strongly the single particle dispersion statistics and remains evident even when the effects of the mean, prevailing motion are ignored. The balloons appear to be trapped in zonal bands corresponding to their launch sites. This is manifested in the time evolution of the meridional displacement variance, which remains constant after about five days after launch. Dissert. Abstr.

N81-20023 Mississippi State Univ., State College.
NUMERICAL SOLUTION OF THREE-DIMENSIONAL NAVIER-STOKES EQUATIONS ON AN ARBITRARILY SHAPED BODY USING A LOCALLY ONE-DIMENSIONAL SCHEME Ph.D. Thesis
Amitabha Ghosh 1980 140 p
Avail: Univ. Microfilms Order No. 8105174

A locally one-dimensional scheme was developed to solve the three-dimensional incompressible Navier-Stokes equations in primitive variables. A fast part iterative scheme was generated for the solution of laminar flow on an arbitrarily shaped body. A boundary fitted three-dimensional curvilinear coordinate system is generated with specified body and outer boundary. For analytical and data storage requirements the computational field has been divided into three subregions. With the potential flow start, the Navier-Stokes solution proceeded marching in time to the steady state. At each time step the split Navier-Stokes velocity and pressure equations were solved in the transformed coordinate system using sweeping in the three coordinate directions at fractional time steps. A no-slip boundary condition on the body surface and Dirichlet as well as Neumann type remote boundary conditions were used. Dissert. Abstr.

N81-20024 Rutgers - The State Univ., New Brunswick, N. J.
SUBSONIC AXISYMMETRIC BASE FLOW CONTROL USING BOUNDARY LAYER THICKNESS AND NEAR-WAKE MASS BALANCE VARIATIONS Ph.D. Thesis
Jose Luis Fernandez Porteiro 1980 167 p
Avail: Univ. Microfilms Order No. 8105040

The influence of the boundary layer thickness and base mass transfer on the wake flow of a blunt based, right circular cylinder immersed in a uniform subsonic flow was studied. The investigation was conducted in an experimental facility specially designed to provide axisymmetric flow over a cylindrical body in the absence of support interference. Layers approaching the base were turbulent and the test section Reynolds. Changes in both the boundary layer thickness and near wake mass transfer were found to alter the base pressure significantly. The base pressure was found to increase with the thickness of the boundary layer. Base bleed also increased the base pressure while base suction had the opposite effect. Detailed measurements of the total and static pressures on the near wake centerline were made. The influence of boundary layer thickness and base mass transfer on the near wake centerline velocity distributions and the location of the stagnation point was studied. Dissert. Abstr.

N81-20025*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AERODYNAMIC CHARACTERISTICS OF A HYPERSONIC CRUISE AIRCRAFT CONCEPT WITH WING-MOUNTED PROPULSION SYSTEMS AT MACH NUMBERS OF 2.96, 3.96 AND 4.63
Gregory D. Riebe and Jimmy L. Pittman Mar. 1981 50 p refs
(NASA-TM-81937; L-14168) Avail: NTIS HC A03/MF A01 CSCL 01A

Longitudinal aerodynamic data are presented for a Mach 6 transport concept at Mach numbers of 2.96, 3.96, and 4.63. The model components consisted of a lenticular cross section fuselage, a wedge slab wedge wing, a horizontal tail set, a wedge center vertical tail, a set of flow through ramjet nacelles mounted under the wing, and a set of turbojet nacelles simulated by solid bodies mounted on the upper surface of the wing. Estimates from hypersonic impact theory were compared with experimental data for several of the test configurations. The method, which applied tangent cone empirical theory to the body and tangent wedge theory to the planar surfaces, generally

provided a good estimate of the fuselage wing tail data. Comparisons, however, for the configuration buildup showed that the theoretical estimates for the various components could be significantly different from the experimental data, which is an indication of errors in the local pressure estimates. Author

N81-20026*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A COMPUTER TECHNIQUE FOR DETAILED ANALYSIS OF MISSION RADIUS AND MANEUVERABILITY CHARACTERISTICS OF FIGHTER AIRCRAFT
Willard E. Foss, Jr. Mar. 1981 67 p
(NASA-TP-1837; L-14213) Avail: NTIS HC A04/MF A01 CSCL 01A

A computer technique to determine the mission radius and maneuverability characteristics of combat aircraft was developed. The technique was used to determine critical operational requirements and the areas in which research programs would be expected to yield the most beneficial results. In turn, the results of research efforts were evaluated in terms of aircraft performance on selected mission segments and for complete mission profiles. Extensive use of the technique in evaluation studies indicates that the calculated performance is essentially the same as that obtained by the proprietary programs in use throughout the aircraft industry. E.D.K.

N81-20027*# Boeing Vertol Co., Philadelphia, Pa.
TOTAL MAIN ROTOR ISOLATION SYSTEM ANALYSIS
V. Sankewitsch Hampton, Va. NASA, Langley Research Center Mar. 1981 82 p refs
(Contract NAS1-16176)
(NASA-CR-165666; D-210-11788-1) Avail: NTIS HC A05/MF A01 CSCL 01A

Requirements, preliminary design, and verification procedures for a total main rotor isolation system at n/rev are presented. The fuselage is isolated from the vibration inducing main rotor at one frequency in all degrees of freedom by four antiresonant isolation units. Effects of parametric variations on isolation system performance are evaluated. E.A.K.

N81-20028*# Barna (P. Stephen), Consultant, Norfolk, Va.
EXPERIMENTAL INVESTIGATIONS ON THE V/STOL TUNNEL AT NASA/LANGLEY RESEARCH CENTER
P. Stephen Barna Feb. 1981 78 p refs
(NASA Order L-12343B)
(NASA-CR-165655) Avail: NTIS HC A05/MF A01 CSCL 01A

The flow characteristics of the V/STOL tunnel were investigated. The results show an interaction between tunnel components. The flow around the tunnel circuit gradually deteriorated with increasing distance from the testing area. The flow in the first diffuser was still satisfactory at the beginning of the circuit, while at the end of the circuit, the flow approaching the contraction became entirely unsatisfactory. Deterioration of flow was due largely to turning the stream around the corners, with the resulting flow distortion affecting the diffusers downstream. The large end of the last diffuser stalled on one side and nearly stalled the flow at the tip of the fan. It was found that these adverse flow characteristics reduce the flow quality and the efficiency of the tunnel. E.A.K.

N81-20029*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE PHENOMENON OF DYNAMIC STALL
W. J. McCroskey Mar. 1981 33 p refs Prepared in cooperation with Army Research and Technology Labs., Moffett Field, Calif.
(NASA-TM-81264; A-8464) Avail: NTIS HC A03/MF A01 CSCL 01A

The general features of dynamic stall on oscillating airfoils are explained in terms of the vortex shedding phenomenon, and the important differences between static stall, light dynamic stall, and deep stall are described. An overview of experimentation and prediction techniques is given. M.G.

N81-20030*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN EXTENSION OF THE LOCAL MOMENTUM THEORY TO A DISTORTED WAKE MODEL OF A HOVERING ROTOR
Keiji Kawachi Feb. 1981 112 p refs
(NASA-TM-81258; A-8436) Avail: NTIS HC A06/MF A01 CSCL 01A

The local momentum theory is based on the instantaneous balance between the fluid momentum and the blade elemental lift at a local station in the rotor rotational plane. Therefore, the theory has the capability of evaluating time wise variations of air loading and induced velocity distributions along a helicopter blade span. Unlike a complex vortex theory, this theory was developed to analyze the instantaneous induced velocity distribution effectively. The boundaries of this theory and a computer program using this theory are discussed. A concept introduced into the theory is the effect of the rotor wake contraction in hovering flight. A comparison of this extended local momentum theory with a prescribed wake vortex theory is also presented. The results indicate that the extended local momentum theory has the capability of achieving a level of accuracy similar to that of the prescribed wake vortex theory over wide range variations of rotor geometrical parameters. It is also shown that the analytical results obtained using either theory are in reasonable agreement with experimental data. E.D.K.

N81-20031*# National Aeronautics and Space Administration, Washington, D. C.
THE ELABORATION OF A NEW FAMILY OF HELICOPTER BLADE PROFILES
J. J. Thibert Jan. 1981 15 p refs Transl. into ENGLISH from L'Aeron. et l'Astron., (France), no. 81, Feb. 1981 p 13-19 Original language document announced as A80-48126 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by ONERA
(Contract NASw-3199)
(NASA-TM-75907) Avail: NTIS HC A02/MF A01 CSCL 01C

An airfoil family of helicopter rotor blades was designed. Three airfoils with thickness to chord ratios of 12, 9, and 7% were designed. Their improved performance in two dimensional rotor mockup wind tunnel tests led to testing of the tapered blades on four bladed rotors in a wind tunnel and flight tests on the Dauphin series of helicopters, confirming the expected gains. J.D.H.

N81-20032# Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.
FURTHER STUDIES ON MAGNUS PHENOMENA ON SPINNING AND CONING BODIES Final Report, 25 Oct. 1978 - 24 Oct. 1980
Eugene E. Covert, D. Scott Eberhardt, and Charles W. Haldeman Dec. 1980 17 p refs
(Contract DAAG29-79-C-0002)
(AD-A095193; TR-209; ARO-15813.3-E) Avail: NTIS HC A02/MF A01 CSCL 20/4

Further research on adapting the magnetic balance system for dynamic testing is reported. System improvements are discussed and initial data on a magnetically-suspended ogive cylinder plunging at 2 Hz are reported. Results of a simplified theoretical model for the Magnus force on a spinning body of revolution are also reported. GRA

N81-20033# Nielsen Engineering and Research, Inc., Mountain View, Calif.
TRANSONIC FLOW PAST PROJECTILES WITH VARIABLE NONAXISYMMETRIC CROSS SECTION Final Report, 15 Aug. 1977 - 15 Jan. 1981
Stephen S. Stahara Jan. 1981 11 p refs
(Contract DAAG29-77-C-0038)
(AD-A095376; NEAR-TR-238; ARO-14944.4-E) Avail: NTIS HC A02/MF A01 CSCL 12/2

This work relates to the development of a predictive method for determining the steady inviscid aerodynamic behavior of ballistic projectiles throughout the transonic range. The development has been directed toward establishing the theoretical capability for predicting the static stability characteristics of both the standard conical boattail projectiles as well as a variety of new nonaxisymmetric boattail shapes under study of the U.S. Army. Provided in the report is a concise statement of the problem studied, a detailed summary of the important research results, and a reference list of the publications. GRA

N81-20034# New Jersey Inst. of Tech., Newark
SIMULATION OF AEROHEATING OR AEROCOOLING AIR FORCE STORES BY ARRAYS OF IMPINGING JETS Final Report, Sep. 1979 - Jul. 1980
Peter Hrycak Oct. 1980 59 p refs
(Contract F33615-79-C-3417; AF Proj. 2402)
(AD-A095464; AFWAL-TR-80-3105) Avail: NTIS HC A04/MF A01 CSCL 20/13

The New Jersey Institute of Technology conducted a conceptual study using existing analytical and experimental data to assess the feasibility of using impinging air jets to heat and cool a large structure such as a store. It was found to be feasible to use impinging jets; however, a prediction of the total mass flow of air required was difficult to accomplish because of the lack of data concerning the efficiencies of arrays of impinging jets. GRA

N81-20035# Calspan Advanced Technology Center, Buffalo, N.Y.
THEORETICAL STUDIES OF THREE DIMENSIONAL TRANSONIC FLOW THROUGH A COMPRESSOR BLADE ROW Final Report
William J. Rae 30 Nov. 1980 26 p refs
(Contract F49620-78-C-0057; AF Proj. 2307)
(AD-A095707; CALSPAN-6275-A-5; AFOSR-81-0112TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

This document contains a summary of efforts to develop a numerical method for calculating the inviscid, three dimensional, transonic flow through a compressor blade row. An implicit time marching algorithm was modified to include periodicity, boundary, and far-field conditions appropriate to internal flow. The computational grid and boundary-conforming coordinates were calculated by a conformal mapping technique, and metrics of the transformation were evaluated from analytic formulas. Calculations of the flow over a two dimensional cascade using a coarse grid, showed that metric singularities near the trailing edge produced large oscillations in the solution. Several approaches for alleviating this problem are discussed. GRA

N81-20036# Aeronautical Research Inst. of Sweden, Stockholm. Dept. of Aerodynamics.
AN APPLICATION OF THE EMBEDDED GRID TECHNIQUE TO THE CALCULATION OF TRANSONIC FLOW PAST WINGS
Sven G. Hedman Sep. 1980 27 p refs
(Contracts F-K-82223-78-003-21-001; F-K-82223-78-170-21-001)
(FFA-TN-AU-1600) Avail: NTIS HC A03/MF A01

The embedded grid technique was applied in a program for calculation of transonic flow over wings. The wing boundary conditions are applied in the inner grid. There is a common border region for exchange between the solutions of the inner and an outer grid. Far field expressions are applied at the exterior surfaces of the outer grid. The flow is governed by small perturbation equations. Two dimensional flow past a NACA 0012 airfoil at ALPHA = 0 deg and M - 0.816 was calculated both in a plain single grid and with the embedded grid technique. It is found that practically identical pressure distributions can be obtained with the two methods and that the size of the inner grid and the amount of overlapping between the two grids are not critical. Good agreement is shown with results obtained by the Euler equations. Three dimensional flow past the straight wing of a NASA wing-body model was calculated for ALPHA = 0.2 deg and M = 0.90. Comparison was made between pressures obtained with the present method and with Jameson's FLO 22. The importance of defining the airfoil by a large number of points is demonstrated. Through the use of the embedded grid technique, a detailed geometry definition is possible, without an undue number of field points and excessive computer time.
Author (ESA)

N81-20037# Aeronautical Research Inst. of Sweden, Stockholm.
THE VELOCITY INDUCED BY THE WAKE OF A WIND TURBINE IN A SHEAR LAYER, INCLUDING GROUND EFFECT
Bo C. A. Johansson Jun. 1980 42 p refs
(FFA-133; ISSN-SW-0081-5640) Avail: NTIS HC A03/MF A01

A theory for the calculation of the velocity field induced by the wake of a horizontal axis wind turbine in a wind shear layer and in the vicinity of a plane ground surface, when the force distribution of the turbine is known, is developed. The turbine is approximated by a disk area of continuous distributions of thrust and force parallel to the disk plane. Its wake is represented by a semi-infinite cylinder of distributed vorticity. A numerical example is calculated and distributions of velocity normal to the disk plane and ground effect influences are shown. The theory is based on assumptions strictly valid only for small perturbations of the undisturbed flow. Author (ESA)

N81-20038# National Aerospace Lab., Amsterdam (Netherlands). Flight Dynamics Div.
UNSTEADY AIRLOADS ON A HARMONICALLY PITCHING WING WITH EXTERNAL STORE
R. Roos 31 Jan. 1980 10 p refs Presented at AIAA/ASME 21st Struct., Structural Dyn. and Mater. Conf., Seattle, 12-14 May 1980 Co-sponsored by AFFDL
(Grant AF-AFOSR-3233-77)
(NLR-MP-80004-U) Avail: NTIS HC A02/MF A01

Wind tunnel tests were carried out on a harmonically pitching fighter-type wing with and without an air to air missile. Steady and unsteady pressure distributions were measured on the wing, while the aerodynamic loads on the store were also obtained. The Mach number ranged from 0.6 to 1.35, while frequencies up to 40 Hz (k = 0.4) were achieved. The influence of the store on the unsteady wing loading, behavior of the unsteady store loads, and comparison with unsteady calculations are examined. It is shown that for transonic conditions the interference due to the tipstore as well as the pylon store spreads over the full wing, while at supersonic speeds the influence remains localized within the Mach cone. The normal load and side load experienced by the store become consistently larger as the complexity of the store increases, while for the pitching moment the contribution of the canard fins is very important. For subsonic flow conditions it is shown that in a matching process with a more expensive panel method. It is possible to define a panel distribution of a doublet lattice calculation which properly accounts for the interference effects due to a store and the store loads themselves. Author (ESA)

N81-20039# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
A PANEL METHOD TO DETERMINE LOADS ON OSCILLATING AIRFOILS IN TRANSONIC FLOW WITH EMBEDDED SHOCK WAVES
M. H. L. Hounjet 7 Mar. 1980 10 p refs Presented at AIAA/ASME 21st Struct., Structural Dyn. and Mater. Conf., Seattle, 12-14 May, 1980 Sponsored by Research Branch of Directorate of Materiel
(NLR-MP-80005-U) Avail: NTIS HC A02/MF A01

A two dimensional panel method which combines supersonic and subsonic linear lifting surface theories is based on the velocity potential panel approach and accounts for the effect of the moving shock. A simplified representation of a mean steady symmetric flow field which is divided into a supersonic constant Mach number region separated by a straight normal shock is used. For a NACA 64A006 airfoil, transonic results are presented and compared with results of an improved version of the LTRAN2 code. A 95% saving in computer run time is realized.
Author (ESA)

N81-20040# Royal Aircraft Establishment, Farnborough (England).
LEADING-EDGE SEPARATION FROM A SLENDER ROLLING WING-BODY COMBINATION
I. P. Jones (Atomic Energy Research Establishment) London HMSO Mar. 1980 72 p refs Sponsored by Univ. of East Anglia, England and UK Ministry of Defence
(RAE-TR-80039; RAE-Aero-3476; BR74711) Avail: NTIS HC A04/MF A01

A vortex-sheet model of leading-edge separation was used to study the flow about a slender wing-body combination in steady rolling motion at zero incidence. The equations which model the flow were derived. For a numerical solution of the equations, the representation of the vortex sheet in the cross flow plane was discretized, so that the unknowns become a

finite set of coordinates and strengths, and the boundary conditions become a finite set of ordinary differential equations. The streamwise derivatives which occur in these equations are represented by central differences in an implicit formulation.
Author (ESA)

N81-20041# Bristol Univ. (England). Dept. of Aeronautical Engineering.
LEADING EDGE DEVICES ON SLENDER WINGS B.S. Thesis
M. F. Cuming and J. G. Dickison Jun. 1980 43 p refs
(BU-250) Avail: NTIS HC A03/MF A01

Wind tunnel tests of flow over a slender delta, of aspect ratio 1, with leading edge slats were performed in order to establish the lift/drag improvements predicted by theory for certain configurations. Flow visualization work included use of helium soap bubbles, smoke filaments, water tank plunges, and surface oil flow. Complicated flow patterns were revealed including multiple vortex sheets. In some cases a tentative explanation is advanced. The lift/drag improvements expected from the use of leading edge slats were confirmed by experiment for certain configurations. For the best case, improvements in lift/drag of up to 20% were obtained at C sub L greater than 0.2, with maximum benefit at C sub L = 0.4. Author (ESA)

N81-20042# Bristol Univ. (England). Dept. of Aeronautical Engineering.
MOTORCYCLE AERODYNAMICS IN PERFORMANCE B.S. Thesis
S. P. N. F. Jowitt and S. J. Kirby Jun. 1980 74 p refs
(BU-253) Avail: NTIS HC A04/MF A01

Aerodynamic coefficients derived from force measurements on a 1/4 scale racing motorcyle in a wind tunnel are integrated into performance analyses to determine their influence. Measurements were made in yaw and roll, with the addition of strakes, and for motorcycles in proximity. The analyses considered were for steady state turning, straight line acceleration and straight line stability. Details of the flow field over the rider, from pressure measurements and visualization, show the existence of two vortices which contribute to drag, lift, and side force. A venturi effect occurs between the motorcycle fairing and ground plane as the motorcycle banks and is modulated by small rider movements. The addition of strakes to the flanks of the fairing has a negligible effect on cornering performance, but reduces the front wheel lift in accelerated motion. The model work is augmented with full scale examination of the rider flow in a wind tunnel and full scale visualization of the flow over the fairing to ensure correct model simulation. Author (ESA)

N81-20043# Bristol Univ. (England). Dept. of Aeronautical Engineering.
AN INVESTIGATION OF DRAG ASSOCIATED WITH THE UPSWEPT REAR FUSELAGE OF A HELICOPTER B.S. Thesis
H. Mistry and R. Lamb Jun. 1980 52 p refs
(BU-257) Avail: NTIS HC A04/MF A01

The effect of flow changes around the rear fuselage of typical helicopter configurations was studied using a one-fifth scale Westland Lynx model. Modifications were added to the rear fuselage in order to vary its geometry. The model was wind tunnel tested at a Reynolds number (based on the length of the fuselage body) of 3.5 million. Two basic fuselage configurations were tested, one with a parallel sided rear fuselage, the other with taper. The effect of upsweep angle and the incidence of the model on lift, drag, and pitching moment was studied. Pressure readings were taken on the rear upswept face and a series of flow visualization tests was also done. Dramatic changes in the flow pattern were found on the parallel sided fuselage configuration. A definite correlation between the pressure changes on the upswept surface associated with the changing flow pattern there and the sudden drag change was confirmed. It was found that rear fuselage taper effectively killed off the critical flow changes although the same types of flow were still present.
Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N81-20044*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A PILOT TRAINING MANUAL FOR THE TERMINAL CONFIGURED VEHICLE ELECTRONIC HORIZONTAL SITUATION INDICATOR
Jacob A. Houck Mar. 1981 64 p refs
(NASA-TM-81959) Avail: NTIS HC A04/MF A01 CSCL 05I

The initial phase of a training program for the Terminal Configured Vehicle Electronic Situation indicator (EHSI) is presented. The EHSI and its symbology is introduced and interpretation of the symbols is explained. Basic symbols shown on the display at all times are first presented. Additional optional symbols to be used as appropriate during different portions of a flight are then introduced and various display configurations interpreted. The upper half of each page is a reproduction of the EHSI display or other pertinent instructional material and the bottom half contains explanatory text, simplifying production of an audiovisual package for use with large training classes. Two quizzes on the course material are included. J.D.H.

N81-20045# Parker (Lee W.), Inc., Concord, Mass.
AIRBORNE LIGHTNING WARNING SYSTEMS: A SURVEY Final Report, Aug. 1979 - Jun. 1980
Lee W. Parker and Heinz W. Kasemir Jul. 1980 108 p refs
(Contract F19628-79-C-0161)
(AD-A095354; AFGL-TR-80-0226) Avail: NTIS HC A06/MF A01 CSCL 01/2

Lightning warning systems for airborne use may be classified in accordance with their application as near-zone warning systems, and distant warning systems. The near-zone systems considered here are essentially electrostatic field detectors (field mill, radioactive probe, and corona point) that can warn of the presence not only of thunderstorms but of high electric fields associated with nonthundery clouds that may nevertheless cause triggered strikes to aircraft (far outnumbering strikes due to natural lightning, according to pilot reports). Lightning-strike and high-field statistics, and associated corona effects, are discussed in connection with triggering of strikes. The distant warning systems considered, aside from airborne weather radar, include RF electric and magnetic sferics detectors, as well as optical systems and the above-mentioned near-zone detectors modified to also detect sferics. The sferics detectors sense electromagnetic fields radiated by lightning and pre-lightning discharges, and may be classified according to their applications as single-station bearing detectors (crossed loops-wideband or narrowband, multiple loops, time-of-arrival and interferometer systems), and as single-station range detectors (crossed loops, 500 KHz pulse-height, spectral-amplitude-ratio/group-delay-difference, electric amplitude, e.g., 1/r-cubed, and ratio-of-magnetic-to-electric-amplitude systems). Many of the systems surveyed have virtues warranting their consideration, as individuals or in combinations, for airborne warning and avoidance application. However, they all have advantages and disadvantages that require further investigation, careful testing and evaluation. GRA

N81-20046# Lockheed-Georgia Co., Marietta. Engineering Systems Analysis Div.
ISSUES OF COMMONALITY. VOLUME 2: ISSUE ANALYSIS Final Report
W. T. Garrett, J. R. Atcheson, D. L. Bouguet, W. A. French, C. R. Needles, R. P. Tuttle, and S. M. Williams Dec. 1980 145 p refs
(Contract F33615-78-C-0115)
(AD-A095418; LG80ER0013-VOL-2) Avail: NTIS HC A07/MF A01 CSCL 01/3

Since 1974, when the Military Airlift Command proposed the concept of commonality between civil and military transport airplanes, the Air Force has sponsored various studies on the technical feasibility, cost effectiveness, and design trade-offs for

a large, advanced technology, transport aircraft. Originally designated C-XX, but now known as the ACMA (Advanced Civil/Military Aircraft), such aircraft would have the potential to meet not only the strategic military airlift needs of the United States at reduced investment, operating, and support costs; but would also provide the worldwide civilian cargo industry with more efficient airfreight capabilities. There are many important institutional issues related to the acceptance of a joint civil/military development concept due to the numerous and significant interactions between government (both military and domestic agencies), in industry (both manufacturers and air carriers), and international aviation interests. These interactions, and the potential conflicts, are the central focus of the Issues of Commonality Study. This report summarizes the work performed to date. GRA

N81-20047# Lockheed-Georgia Co., Marietta. Engineering Systems Analysis Div.

ISSUES OF COMMONALITY. VOLUME 1: EXECUTIVE SUMMARY Final Report

W. T. Garrett, J. R. Atcheson, D. L. Bouguet, W. A. French, C. R. Needles, R. P. Tuttle, and S. M. Williams Dec. 1980 20 p (Contract F33615-78-C-0115)

(AD-A095417; LG80ER0013-VOL-1) Avail: NTIS HC A02/MF A01 CSCL 01/3

The Issues of Commonality Study examines the significant institutional issues related to the acceptance of a concept for the development of a new large cargo aircraft. The proposed aircraft, referred to as the ACMA (Advanced Civil/Military Aircraft), nee C-XX is conceived as an advanced technology transport with the potential for fulfilling both the U.S. need for military airlift and the worldwide need for commercial airfreight in the 1990s and beyond. There are many political and socio-economic considerations to be addressed when formulating a program involving government and industry participants with their particular and diverse interests. This study focuses on these interfaces and potential problem areas and examines four issues thought to be of more immediate concern to the successful initiation of a joint civilian/military venture. These issues are: establishing the commerical need, U.S. and international; development of a financial planning concept; energy considerations that may impact the program; and impact of engine development/acquisition. GRA

N81-20048# Analysis and Technology, Inc., North Stonington, Conn.

EVALUATION OF NATIONAL SAR MANUAL: PROBABILITY OF DETECTION CURVES Interim Report, Jan. 1978 - Sep. 1980

N. C. Edwards, Jr., T. J. Mazour, R. A. Bemont, and S. R. Osmer Sep. 1980 60 p refs

(Contract DOT-CG-81-79-2038)

(AD-A095748; USCG-D-41-80) Avail: NTIS HC A04/MF A01 CSCL 06/7

Since September 1978 three controlled visual detection experiments providing 966 target detection opportunities in 322 searches have been conducted by the U.S.C.G. Research and Development Center. These experiments involved 82 and 95-foot cutters, 41 and 44-foot boats, helicopters, and fixed wing aircraft searching for 16-foot boat and life raft targets. This report compares the detection performance of these search and rescue units (SRUs) with the probability of detection (POD) curves of the National Search and Rescue Manual, and recommends revised predictions based upon these results. Experiment results indicate that actual SRU detection performance falls below that of the present SAR Manual POD curves (based upon the inverse cube law of detection) and above that of the uniform random search curve. Recommendations are also provided for methods to predict POD directly from probability of detection versus lateral range curves for use with the Computer-Assisted Search Planning (CASP) model. GRA

N81-20019# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.

EXPERIENCES WITH FLIGHT RECORDERS OBTAINED BY ANALYZING AIRCRAFT ACCIDENTS

O. Weber and G. Rosenau *In its* On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 293-321 refs In GERMAN; ENGLISH summary (For primary document see N81-20007 11-01)

Avail: NTIS HC A16/MF A01

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N81-20049# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

FINITE-DIFFERENCE METHOD FOR THE ARBITRARY CROSS-SECTION WAVEGUIDE PROBLEM USING THE BEST-FIT BOUNDARY APPROXIMATION

Pawel Rozenfeld, Luiz Alberto Campos Mello, and Array Buss Filho Dec. 1980 10 p refs Submitted for publication

(INPE-1956-RPE/270) Avail: NTIS HC A02/MF A01

A computer program is described which maintains the simplicity of the usual finite difference method and which uses the best-fit approximation to the cross-section of a waveguide. As a result a better precision is obtained and smaller computer time is used in the solution of the dominant mode of the hollow homogeneous waveguide problem. Computed values of the cutoff frequencies for several waveguides are presented. M.G.

N81-20050*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

OPERATIONAL CONSIDERATIONS IN UTILIZATION OF MICROWAVE LANDING SYSTEM APPROACH AND LANDING GUIDANCE

William F. White and Leonard V. Clark Mar. 1981 33 p refs Presented at the 1980 Aircraft Safety and Operating Probl. Conf., Hampton, Va., 5-7 Nov. 1980 Submitted for publication

(NASA-TM-81945; L-14330) Avail: NTIS HC A03/MF A01 CSCL 17G

The characteristics of microwave landing system (MLS) equipment are reviewed and the flight performance of the terminal configured vehicle B-737 airplane during nearly five years of flight experience with MLS is summarized. Most of these flights involved curved, descending flight paths with automatic landings and final approaches as short as 0.44 n. mi. Possible uses to solve noise abatement problems with MLS equipment of varying degrees of complexity are discussed. It is concluded that altitude derived from MLS is superior to other sources near the airport traffic pattern. E.A.K.

N81-20051*# Analytical Mechanics Associates, Inc., Mountain View, Calif.

GENERATION OF OPTIMUM VERTICAL PROFILES FOR AN ADVANCED FLIGHT MANAGEMENT SYSTEM Final Report

John A. Sorensen and Mark H. Waters Mar. 1981 153 p refs

(Contract NAS1-15497)

(NASA-CR-165674) Avail: NTIS HC A08/MF A01 CSCL 17G

Algorithms for generating minimum fuel or minimum cost vertical profiles are derived and examined. The option for fixing the time of flight is included in the concepts developed. These algorithms form the basis for the design of an advanced on-board flight management system. The variations in the optimum vertical profiles (resulting from these concepts) due to variations in wind, takeoff mass, and range-to-destination are presented. Fuel savings due to optimum climb, free cruise altitude, and absorbing delays enroute are examined. E.D.K.

N81-20052*# Ohio Univ., Athens. Avionics Engineering Center.

LORAN-C PLOTTING PROGRAM FOR PLOTTING LINES OF

POSITION ON STANDARD CHARTS
James P. Roman Feb. 1981 28 p refs
(Grant NGR-36-009-017)
(NASA-CR-164082; TM-78) Avail: NTIS HC A03/MF A01 CSCL 17G

A set of programs used to plot Loran C lines of position on any common map or standard aviation sectional chart are given. The Loran C plotting program JRPLOT FORTRAN uses a standard Calcomp compatible plotting subroutine package for the Hewlett-Packard 7203A graphic plotter. The programs are designed to be run on an IBM System 370 computer. A simple add subtract method is used to calculate the lines of position. A description of how to use the program and some methods of operation are given. J.D.H.

N81-20053*# Ohio Univ., Athens. Dept. of Electrical Engineering.
AUTOMATIC GAIN CONTROL
James P. Roman Mar. 1981 8 p refs
(Grant NGR-36-009-017)
(NASA-CR-164082; TM-79) Avail: NTIS HC A02/MF A01 CSCL 17G

An automatic gain control (AGC), designed to operate with the prototype Loran-C receiver, is described. The device is used to eliminate error which occurs when signals are received at different magnitudes. The automatic gain control is a three transistor circuit which requires a constant dc voltage of 8 volts. Tests conclude that this value may be in the range of 4 to 12 v without change in circuit performance. Two transistors are cascaded to pass and amplify the input signal. Their gain is controlled by a third transistor which itself is controlled by an external AGC voltage between 0 and 8 volts dc. The integrated circuit used is an 8 pin chip, which is a differential cascade amplifier designed for use in communications operating at frequencies from dc to 120 MHz. The integrated circuit was balanced for AGC capabilities, and has a wide operating current range. The maximum input current at pins 1 and 5 is 0.1 mAmps. AGC testing is described. M.G.

N81-20054# Martin Marietta Aerospace, Denver, Colo.
TOTAL SYSTEM DESIGN METHODOLOGY Final Technical Report, 23 Aug. 1978 - 31 Aug. 1980
Edward C. Stanke, II Jan. 1981 71 p
(Contract F30602-78-C-0250; AF Proj. 5581)
(AD-A095727; RADC-TR-80-337) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report describes the Total Systems Design Methodology, including the philosophy, automated and manual tools and procedures which support it. It also documents the applications of that methodology to the Navstar Global Positioning System Operational Control Segment system definition and conclusions based on that application. GRA

N81-20055# Massachusetts Inst. of Tech., Cambridge.
INITIAL DESIGN AND EXPERIMENTAL IMPLEMENTATION OF THE TRAFFIC ADVISORY SERVICE OF ATARS
Jeffrey L. Gertz 3 Nov. 1980 148 p refs
(Contracts F19628-80-C-0002; DOT-FA72-WAI-261)
(AD-A095462; ATC-101; FAA-RD-80-117) Avail: NTIS HC A07/MF A01 CSCL 17/7

The FAA Automatic Traffic Advisory and Resolution Service (ATARS) is a ground-based collision avoidance system which utilizes surveillance data from the Discrete Address Beacon System (DABS). It computes traffic advisories and collision warnings using a ground computer independent of the ATC computer system, and delivers these messages to aircraft via the DABS data link. ATARS provides both a traffic advisory and a resolution (collision avoidance) service to aircraft equipped with a DABS transponder, an altitude encoder (mode C), and an ATARS display. The objective of the ATARS effort reported was the design of a traffic advisory service that complements the ground based resolution service while being compatible with the other applications being developed for the DABS data link. The main technical issue was the construction of a set of message formats that provides the pilot with all information he requires while minimizing data link loading. Furthermore, this message set had to support a wide spectrum of onboard equipment, from a simple ring of lights to a sophisticated graphics system. GRA

N81-20056# Federal Aviation Administration, Atlantic City, N.J.
FLIGHT TESTS OF THE MICROWAVE LANDING SYSTEM MULTIMODE DIGITAL PROCESSOR Final Report, Aug. - Nov. 1980
John Warren Jan. 1981 75 p refs
(AD-A095449; FAA-CT-80-19) Avail: NTIS HC A04/MF A01 CSCL 17/7

Flight tests were performed in order to evaluate four digital airborne processing techniques. Four techniques used for processing Microwave Landing System (MLS) time reference scanning beam (TRSB) signals are: (1) dwell-gate processing (DGP), (2) single-edge processing (SEP), (3) dual-edge processing (DEP), and (4) splitgate processing (SPGT). These techniques were flight tested under standard partial orbits, glide slopes, and aircraft shadowing. Overall, the SPGT and DGP techniques resulted in about the same errors. The SEP data were noisier than the DGP but usually had about the same bias. The DEP technique was always inferior to the DGP. Aircraft shadowing errors were excessive for all techniques and should be avoided by operatin; procedures when an aircraft nears the touchdown region. It is recommended that the DEP algorithm be changed for improved noise performance and flight tests be performed using all four processing techniques in a specular multipath environment and under conditions using two azimuth antennas having different beam widths (these tests were not performed because of equipment nonavailability during flight testing). GRA

N81-20057# Air Force Geophysics Lab., Hanscom AFB, Mass.
ERROR ANALYSIS AND PERFORMANCE DATA FROM AN AUTOMATED AZIMUTH MEASURING SYSTEM
James A. Shearer, Joseph A. Miola, Howard Musoff, David Anthony, and Robert J. Gauthier 17 Feb. 1981 11 p refs Presented at Conf. of AIAA, Danvers, Mass.
(AF Proj. 7600)
(AD-A095446; AFGL-TR-81-0033) Avail: NTIS HC A02/MF A01 CSCL 17/7

The determination of precise time-dependent azimuths is an important requirements for evaluation and maintenance of inertial navigation instruments. Improved technology now demands a test and evaluation accuracy of less than one arc second, which means that geophysical and environmental effects on the time stability of azimuth references are now quite significant. Similarly, azimuthal motions of the test equipment, which are inherent in the tests themselves, must also be evaluated. This paper discusses an automated inertial azimuth measuring system which was used to track the azimuthal motion of test references at Holloman AFB, NM. A detailed error analysis of the system and methods to improve performance and accuracy are presented. Discussion includes selected alternatives for improving state-of-the-art azimuth measurement. GRA

N81-20058# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
EVALUATION OF THE VISUAL ACQUISITION RANGE OF EN-ROUTE AIR TRAFFIC FROM COCKPIT OBSERVATIONS
Otto Weber Sep. 1980 54 p refs In GERMAN; ENGLISH summary Original report in GERMAN will also be announced as translation (ESA-TT-691)
(DFVLR-Mitt-80-14) Avail: NTIS HC A04/MF A01

On-board observations and approach head time measurements are employed. The results of 29 measurement campaigns conducted by airline pilots are analyzed. Evaluation method are described and problems due to converging courses and large cross track distances in the head-on case are treated in detail. The results for the acquisition range and the apparent size of the intruder derived from this range are discussed. The advantages of anticollision and position lights, vapor trails and air traffic control signals for the acquisition process are demonstrated. Proposals for improving data acquisition in the future are included. Author (ESA)

N81-20059# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
THE SEMI-OPERATIONAL EVALUATION OF THE TRAJECTORY PREDICTION METHOD FOR SIGNAL AUTOMATIC RADAR PROCESSING (SARP) 2

J. M. tenHave Sep. 1979 16 p refs Presented at 6th SPACDAR Meeting, Brussels, 7-9 Nov. 1979 Sponsored by Netherlands Civil Aviation Dept. (RLD)
(NLR-MP-79038-U) Avail: NTIS HC A02/MF A01

Results of the evaluation under semi-operational conditions of the SARP 2 trajectory prediction method are presented. Flight data of some 1000 inbound, outbound and transit flights in the Netherlands FIR were analyzed. In the SARP 2 software, the elapsed time computations for the successive reporting points are based on the ground speed of the aircraft and the lengths of the straight segments connecting these reporting points. Ground speed is computed using true airspeed obtained from the filed flight plan or stored aircraft performance data and the wind component. The design objective of 120 sec was achieved in most cases. Trajectory prediction is acceptable in the present SARP environment. For inbound, outbound, and transit flights, 60 to 70% of the aircraft show a trajectory computation error less than 45 seconds. The mean value of the time errors is rather small, while the standard deviation is comparatively large. Possible improvements are proposed, based on more extensive use of radar and flight plan data. Author (ESA)

N81-20018# Eurocontrol Agency, Brussels (Belgium).
POSSIBLE ONLINE USES OF AIDS DATA IN FUTURE ATC SYSTEMS
M. E. Cox *In* DFVLR On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 263-291 refs (For primary document see N81-20007 11-01)
Avail: NTIS HC A16/MF A01

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N81-20060 Michigan Univ., Ann Arbor.
OPTIMUM MANEUVERS OF SUPERSONIC AIRCRAFT, VOLUMES 1 AND 2 Ph.D. Thesis
Ching-Fang Lin 1980 560 p
Avail: Univ. Microfilms Order No. 8106178

Several optimum maneuvers of supersonic aircraft are investigated. Topics include optimum supersonic cruise; minimum time, minimum radius, and minimum fuel turns on a horizontal plane; and optimum maneuvers on a vertical plane which consist of maximum range glide, minimum time zoom climb, minimum time loop, Immelman, and Split-S maneuvers. The discussion emphasizes the analytic aspect of the theory. This has the advantage of a general discussion of any particular problem since the behavior of the optimal control does not depend on any particular measuring system, but rather on a certain number of important dimensionless performance parameters which need to be displayed explicitly. When necessary, numerical solutions are presented to show the quantity, and furthermore, the quality behavior of the optimal trajectory and the optimal control to guide the aircraft along a particular trajectory. In order to facilitate smooth application of the optimal control theory to analyze a wide range of flight programs of practical interest, two mathematical modelings of the aerodynamic and engine characteristics are designed in the form of a lightweight fighter called the supercruiser and a rocket powered aircraft by which dimensionless equations of motion for three dimensional flight over a flat earth are derived. Dissert. Abstr.

N81-20061 Oregon State Univ., Corvallis.
APPLICATION OF LINEAR QUADRATIC CONTROL IN REDUCTION OF AERODYNAMIC FORCES ON AIRCRAFT Ph.D. Thesis
Shou Yuan Wei 1981 277 p
Avail: Univ. Microfilms Order No. 8105191

A problem found in high speed transport aircraft is excessive tail loading when flying at cruise speeds through turbulence. Attempts to reduce these aerodynamic forces on the tail may result in unstable aircraft motions. Using a linear quadratic regulator in conjunction with a Kalman filter, the feasibility of designing an autopilot utilizing the ailerons and rudder is studied in terms of minimal combined lateral ride motion and aerodynamic tail force. A numerical algorithm for solving general quadratic regulator and state estimation problems is developed, and is presented with a computer program to solve the complicated matrix equations involved. A systematic procedure is developed for choosing a reduced combination of sensors which gives near optimal performance. With this approach, aerodynamic tail forces can be theoretically reduced by 20 to 50 percent. Dissert. Abstr.

N81-20062*# Boeing Commercial Airplane Co., Seattle, Wash. Preliminary Design Dept.
INTEGRATED APPLICATION OF ACTIVE CONTROLS (IAAC) TECHNOLOGY TO AN ADVANCED SUBSONIC TRANSPORT: PROJECT PLAN Final Report
Washington NASA Feb. 1981 43 p
(Contracts NAS1-14742; NAS1-15325)
(NASA-CR-3305; D6-46691) Avail: NTIS HC A03/MF A01 CSCL 01C

The state of the art of active controls technology (ACT) and a recommended ACT development program plan are reviewed. The performance benefits and cost of ownership of an integrated application of ACT to civil transport aircraft is to be assessed along with the risk and laboratory and/or flight experiments designed to reduce the technical risks to a commercially acceptable level. E.A.K.

N81-20063*# ECON, Inc., San Jose, Calif.
STUDY OF MATERIALS PERFORMANCE MODEL FOR AIRCRAFT INTERIORS Final Report
K. Leary and J. Skratt 31 Aug. 1980 86 p
(Contract NAS2-10515)
(NASA-CR-152378) Avail: NTIS HC A05/MF A01 CSCL 01C

A demonstration version of an aircraft interior materials computer data library was developed and contains information on selected materials applicable to aircraft seats and wall panels, including materials for the following: panel face sheets, bond plies, honeycomb, foam, decorative film systems, seat cushions, adhesives, cushion reinforcements, fire blocking layers, slipcovers, decorative fabrics and thermoplastic parts. The information obtained for each material pertains to the material's performance in a fire scenario, selected material properties and several measures of processability. T.M.

N81-20064# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
APPLICATION OF A STRUCTURAL OPTIMIZATION PROCEDURE FOR ADVANCED WINGS
H. Godel (Messerschmitt-Boelkow-Blohm GmbH, Munich, West Germany) and G. Schneider (Messerschmitt-Boelkow Blohm GmbH, Munich, West Germany) Jan. 1981 20 p refs Presented at the 51st Meeting of the AGARD Struct. and Mater. Panel, Aix-en-Provence, France, 14-19 Sep. 1980
(AGARD-R-691; ISBN-92-835-1379-7) Avail: NTIS HC A02/MF A01

A computer software called ASAT exists which allows an automatic design of minimum weight structures. The application of the system to several structures is described. It is shown that a structural optimization system can be very useful in the preliminary design of an airplane, especially when it consists of several modules such as static load calculation, deformations and stress calculation by finite elements, static aeroelastics, weight calculation, unsteady aerodynamic forces, vibration calculation, flutter calculation, flutter, and strength optimization which all can be used separately and independently. E.D.K.

N81-20065*# Mississippi State Univ., Mississippi State.
INVESTIGATION OF FLIGHT TEST METHODS FOR MEASURING THE PERFORMANCE OF GENERAL AVIATION AIRCRAFT Semiannual Status Report, 1 Jul. 1980 - Feb. 1981
Gifford Bull and Philip D. Bridges 1981 17 p
(Grant NAG1-3)
(NASA-CR-164057) Avail: NTIS HC A02/MF A01 CSCL 01C

A theoretical and experimental investigation of methods for

measuring the performance of general aviation airplanes was conducted using relatively simple instrumentation currently available and data extraction techniques established from efforts in other disciplines. The possibilities of improving flight test data by use of improved modern instrumentation and digital data recording and data analysis were considered. E.D.K.

N81-20066*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
RECENT PROGRESS IN V/STOL AIRCRAFT TECHNOLOGY Final Report
L. Roberts, W. Deckert, and D. Hickey Mar. 1981 13 p refs
(NASA-TM-81281; A-8512) Avail: NTIS HC A02/MF A01 CSCL 01C

Results from wind tunnel and flight tests investigations for V/STOL aircraft are reviewed. Primary emphasis is given to technical results relating to three types of subsonic aircraft: a quiet STOL aircraft; a tilt rotor aircraft; and a turbofan V/STOL aircraft. Comparison and correlation between theoretical and experimental results and between wind tunnel and flight test results, is made. The quiet STOL aircraft technology results are primarily those derived from the NASA/Boeing Quiet Short Haul Technology (QSRA) program. The QSRA aircraft uses an upper surface blown flap and develops a usable engine-out landing approach lift coefficient of 5.5 and landing distances less than 1,000 ft. The tilt rotor aircraft technology results are those obtained from the NASA/Army/Navy/Bell (XV-15-TRRA) aircraft flight investigations. The TRRA is a twin rotor research aircraft capable of vertical takeoff and landing and cruise speeds of 300 knots. The turbofan V/STOL aircraft technology results are from static ground facility and wind tunnel investigations of a NASA/NAVY/Grumman full scale lift/cruise fan aircraft model, which features two tilting nacelles with TF-34 engines. Author

N81-20067*# Kentron International, Inc., Hampton, Va.
A STUDY OF HIGH-ALTITUDE MANNED RESEARCH AIRCRAFT EMPLOYING STRUT-BRACED WINGS OF HIGH-ASPECT-RATIO
Paul M. Smith, John DeYoung, William A. Lovell, Jack E. Price, and G. Fred Washburn Feb. 1981 93 p refs
(Contract NAS1-16000)
(NASA-CR-159262) Avail: NTIS HC A05/MF A01 CSCL 01C

The effect of increased wing aspect ratio of subsonic aircraft on configurations with and without strut bracing. Results indicate that an optimum cantilever configuration, with a wing aspect ratio of approximately 26, has a 19% improvement in cruise range when compared to a baseline concept with a wing aspect ratio of approximately 10. An optimum strut braced configuration, with a wing aspect ratio of approximately 28, has a 31% improvment in cruise range when compared to the same baseline concept. This improvement is mainly due to the estimated reduction in wing weight resulting from use of lifting struts. All configurations assume the same mission payload and fuel. The drag characteristics of the wings are enhanced with the use of laminar flow airfoils. A method for determining the extent of attainable natural laminar flow, and methods for preliminary structural design and for aerodynamic analysis of wings lifting struts are presented. E.A.K.

N81-20068*# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
THE PREDICTION OF NORMAL FORCE AND ROLLING MOMENT COEFFICIENTS FOR A SPINNING WING
Barnes W. McCormick Feb. 1981 22 p refs
(NASA Order L-13435B)
(NASA-CR-165680) Avail: NTIS HC A02/MF A01 CSCL 01C

Nonlinear airfoil section data for angles of attack from 0 to 180 deg were used in a small computer code to numerically integrate the section normal force coefficients along the span as a function of the local velocity and angle of attack resulting from the combined spinning and descending motion. A correction was developed to account for the radial pressure gradient in the separated, rotating flow region above the wing. This correction was found to be necessary in order to obtain agreement, both in form and magnitude, with rotary balance test data. T.M.

N81-20069# General Accounting Office, Washington, D. C.
THE F/A-18 NAVAL STRIKE FIGHTER: PROGRESS HAS BEEN MADE BUT PROBLEMS AND CONCERNS CONTINUE
18 Feb. 1981 41 p
(AD-A095287; GAO/MASAD-81-3) Avail: NTIS HC A03/MF A01 CSCL 01/3

Contents: Technical problems still exist but progress has been made; F/A-18 reliability and maintainability continue to improve despite problem areas, and F/A-18 program costs are steadily increasing. GRA

N81-20070# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
STATISTICAL REVIEW OF COUNTING ACCELEROMETER DATA FOR NAVY AND MARINE FLEET AIRCRAFT Semiannual Summary Report, 1 Jan. 1962 - 30 Jun. 1980
Warren J. Williams 1 Nov. 1980 144 p
(AD-A095617; NADC-13920-2) Avail: NTIS HC A07/MF A01 CSCL 01/1

This report is a specialized summary of normal acceleration data recorded by counting accelerometers. Data are separated by calendar time and mission category. Only data reported in the counting accelerometer program are included. GRA

N81-20071# Rockwell International Corp., Cedar Rapids, Iowa. Collins Radio Group.
DELTA ELECTRICAL LOAD ANALYSIS C-141B JACC/CP AIRCRAFT
G. R. Taylor 1980 8 p
(Contract F09603-80-C-0602)
(AD-A095659) Avail: NTIS HC A02/MF A01 CSCL 01/3

The installation of the provisions to accept the JACC/CP Capsule in the C-141B Aircraft causes a change to the electrical loads within the present aircraft power distribution system. The purpose of this report is to furnish a tabulation of the changes to the aircraft power system caused by this installation. The electrical load changes to the C-141B aircraft power system caused by this installation are insignificant and causes minimum change to the available growth capacity. GRA

N81-20072# Rockwell International Corp., Dallas, Tex. Collins Radio Group.
STRESS ANALYSIS OF AIRCRAFT MODIFICATIONS (C-141B AIRCRAFT). JOINT AIRBORNE COMMUNICATIONS CENTER/COMMAND POST (JACC/CP) PROVISIONS
D. B. Ragan 27 Oct. 1980 158 p refs
(Contract F08603-80-C-0602)
(AD-A095634) Avail: NTIS HC A08/MF A01 CSCL 01/3

Stress analyses were performed on the following aircraft modifications: AT1108 Antenna Installation, HF Longwire Installation, UPS-192 Antenna Installation, 437S-1C Antenna Installation, and SATCOM Antenna Installation. The detailed conclusions of each of the topics above are contained after each sub-analysis. However, the general conclusion is that each of the subject modifications in no way impare the airworthiness of the aircraft in that the aircraft strength is equal to or greater than the original unmodified strength. GRA

N81-20073# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
TEST AND EVALUATION OF FOAM-IN-PLACE FUEL TANK CONTAINER Progress Report, Nov. - Dec. 1980
Shui-Nan Chuang Dec. 1980 24 p
(AD-A095747; PTPD-80-22) Avail: NTIS HC A02/MF A01 CSCL 13/4

One single pack, F-100 aircraft, 200 gallon fuel tank foam-in-place (FIP), reusable container fabricated by Instapak, Sealed Air Corporation, Danbury CN 06810 was tested by the Air Force Packaging Evaluation Agency (AFPEA), Wright-Patterson AFB OH 45433. The container was tested IAW Federal Test Method Standard (FTMS) 101B, MIL-STD-810C and MIL-P-116G. Although a crack, with a maximum 1/2 in. gap, across the bottom section of the container resulted from the temperature shock test, the container passed all of the requirements as specified for this project except the cyclic exposure test. Improvements resulting from this evaluation will be incorporated into the

fabrication of two additional prototype containers for the F-4 aircraft, 370 and 600 gallon fuel tanks. GRA

N81-20008# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Flugmechanik und Flugreglung.
FLIGHT DATA RECORDING AND DATA PROCESSING FOR LIGHT AIRPLANES AND GLIDERS
J. W. Siefert *In* DFVLR On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 9-33 In GERMAN; ENGLISH summary (For primary document see N81-20007 11-01)
Avail: NTIS HC A16/MF A01

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N81-20074*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
DIVERSITY TECHNIQUES FOR OMNIDIRECTIONAL TELEMETRY COVERAGE OF THE HiMAT RESEARCH VEHICLE
Paul F. Harney Mar. 1981 18 p refs
(NASA-TP-1830; H-1133) Avail: NTIS HC A02/MF A01 CSCL 09F

The highly maneuverable aircraft technology (HiMAT) remotely piloted research vehicle (RPRV) was flight tested and a number of technological advances applicable to future fighter aircraft were demonstrated. The aircraft control system uses airborne and ground-based computers which communicate via uplink and downlink telemetry. Antenna radiation patterns are normally much less than ideal for continuous reception or transmission for all aircraft attitudes. After flight qualification and testing on other aircraft, a frequency diversity concept and an antenna diversity concept were implemented on the HiMAT vehicle to obtain omnidirectional telemetry coverage. E.A.K.

N81-20075# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
TESTING AIRCRAFT INSTRUMENTS Final Report
11 Feb. 1981 26 p refs
(AD-A095680; TOP-6-3-013) Avail: NTIS HC A03/MF A01 CSCL 01/4

This TOP establishes procedures and provides guidance for the functional testing of aircraft instruments and for the testing of the logistics support system required to return aircraft instruments to proper functioning condition after failure. Aircraft instruments include basic flight and aircraft systems performance/health indicators. Functional testing implies the test item is properly installed in the appropriate aircraft and evaluated throughout the operational range of the aircraft mission scenario. The primary objectives of this TOP are: (a) To determine if the designated aircraft instrument performs its intended function in accordance with the requirements presented in the applicable approved documents; Letter Requirement (LR), Letter of Agreement (LOA), Required Operational Characteristics (ROC), Materiel Needs (MN), etc., as reflected through the TECOM Test Directive; (b) To evaluate the human factors engineering (HFE) functional characteristics; and (c) To evaluate the installation and operational compatibility of the designated aircraft instrument with the aircraft interface, other instruments, and aircraft systems. GRA

N81-20012# British Airways, Middlesex (England).
A SHORT NOTE ON AIDS AND WINDSHEAR: BRITISH AIRWAYS EXPERIENCE
A. Fisher and C. A. Vassie *In* DFVLR On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 121-134 refs (For primary document see N81-20007 11-01)
Avail: NTIS HC A16/MF A01

N81-20013# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
INDIVIDUAL JET ENGINE STRESS LOAD MONITORING WITH THE AID OF THE FLIGHT DATA RECORDING SYSTEM LEADS 200
J. Knittel and B. Mueller *In* DFVLR On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 135-151 In GERMAN; ENGLISH summary (For primary document see N81-20007 11-01)
Avail: NTIS HC A16/MF A01

N81-20017# Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany).
THE A310 AIRCRAFT INTEGRATED DATA SYSTEM (AIDS)
H. Kalbe *In* DFVLR On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 235-262 refs (For primary document see N81-20007 11-01)
Avail: NTIS HC A16/MF A01

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N81-20076*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REASONS FOR LOW AERODYNAMIC PERFORMANCE OF 13.5-CENTIMETER-TIP-DIAMETER AIRCRAFT ENGINE STARTER TURBINE
Jeffrey E. Haas, Richard J. Roelke, and Paul Hermann (Sundstrand Corp., Rockford, Ill.) Mar. 1981 18 p Presented at the SAE Aerospace Meeting, Los Angeles, 13-16 Oct. 1980
(NASA-TP-1810; E-540; AVRADCOM-TR-80-C-17) Avail: NTIS HC A02/MF A01 CSCL 21E

The reasons for the low aerodynamic performance of a 13.5 cm tip diameter aircraft engine starter turbine were investigated. Both the stator and the stage were evaluated. Approximately 10 percent improvement in turbine efficiency was obtained when the honeycomb shroud over the rotor blade tips was filled to obtain a solid shroud surface. Efficiency improvements were obtained for three rotor configurations when the shroud was filled. It is suggested that the large loss associated with the open honeycomb shroud is due primarily to energy loss associated with gas transportation as a result of the blade to blade pressure differential at the tip section. E.A.K.

N81-20077 General Accounting Office, Washington, D. C.
A LOOK AT NASA'S AIRCRAFT ENERGY EFFICIENCY PROGRAM
General Accounting Office 28 Jul. 1980 4 p
(PSAD-80-50) Avail: NTIS HC A02/MF A01

The status of the Aircraft Energy Efficiency (ACEE) program the coordination effectiveness between NASA and the Department of Defense (DOD), the need for periodic reporting to the Congress on efforts as ACEE, and NASA's role in aeronautical R&D are examined. The ACEE program accounted for over one third of NASA's aeronautical budget for fiscal year 1980 and will decrease to 29 percent in fiscal year 1981. Details on ACEE costs and funding for NASA's aeronautical research and technology program are appended. E.A.K.

N81-20078*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.
EXTENDED FREQUENCY TURBOFAN MODEL Final Report
J. R. Mason, J. W. Park, and R. F. Jaekel 15 Dec. 1980 104 p refs
(Contract NAS3-21607)
(NASA-CR-165261; FR-13983) Avail: NTIS HC A06/MF A01 CSCL 21E

The fan model was developed using two dimensional modeling

techniques to add dynamic radial coupling between the core stream and the bypass stream of the fan. When incorporated into a complete TF-30 engine simulation, the fan model greatly improved compression system frequency response to planar inlet pressure disturbances up to 100 Hz. The improved simulation also matched engine stability limits at 15 Hz, whereas the one dimensional fan model required twice the inlet pressure amplitude to stall the simulation. With verification of the two dimensional fan model, this program formulated a high frequency F-100(3) engine simulation using row by row compression system characteristics. In addition to the F-100(3) remote splitter fan, the program modified the model fan characteristics to simulate a proximate splitter version of the F-100(3) engine. T.M.

N81-20079*# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
AERODYNAMICS OF ADVANCED AXIAL-FLOW TURBOMACHINERY Final Report, 1 Oct. 1978 - 30 Sep. 1980
George K. Serovy, Patrick Kavanagh, and Theodore H. Kiishi 30 Nov. 1980 93 p refs Sponsored in part by NASA
(Contract F49620-79-C-0002; AF Proj. 2307)
(NASA-CR-163995; AD-A095705; ISU-ERI-AMES-81104; TCRL-17; AFOSR-81-0109TR) Avail: NTIS HC A05/MF A01 CSCL 20/4

A multi-task research program on aerodynamic problems in advanced axial-flow turbomachine configurations was carried out at Iowa State University. The elements of this program were intended to contribute directly to the improvement of compressor, fan, and turbine design methods. Experimental efforts in intra-passage flow pattern measurements, unsteady blade row interaction, and control of secondary flow are included, along with computational work on inviscid-viscous interaction blade passage flow techniques. This final report summarizes the results of this program and indicates directions which might be taken in following up these results in future work. In a separate task a study was made of existing turbomachinery research programs and facilities in universities located in the United States. Some potentially significant research topics are discussed which might be successfully attacked in the university atmosphere. GRA

N81-20080# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
CONCEPT DEFINITION: RETIREMENT FOR CAUSE OF F-100 ROTOR COMPONENTS Final Report, Jun. 1977 - Mar. 1980
J. A. Harris, Jr., D. L. Sims, and C. G. Annis, Jr. Sep. 1980 46 p refs
(Contract F33615-76-C-5172; AF Proj. 7351)
(AD-A095584; PWA-FR-13144; AFWAL-TR-80-4118) Avail: NTIS HC A03/MF A01 CSCL 21/5

Historically, gas turbine engine disks are retired when they accrue an analytically determined lifetime where the first fatigue crack per 1000 disks could be expected. By definition then, 99.9% of these components are being retired prematurely. Retirement-for-cause (RFC) is a procedure, based on fracture mechanics, which would allow safe utilization of the full life capacities of each individual disk. Since gas turbine disks are among the most costly of engine components, adopting a RFC philosophy could result in substantial systems life cycle cost savings. These would accrue from reduced replacement costs, conservation of strategic materials such as cobalt, and energy savings. This study addresses the application of this concept to the USAF F100 engine. GRA

N81-20081# Rolls-Royce Ltd., Derby (England).
THE OPTIMUM DESIGN OF BY-PASS ENGINES WITH JET MIXING
Albrecht Hartmann (Technische Hochschule, Aachen) 1980 18 p refs
(PNR-90017; Trans-15028) Avail: NTIS HC A02/MF A01

The advantages of mixing exhaust and by-pass flow in a by-pass engine are studied. Computer calculations are presented showing the influences of primary flow pressure ratio, gas temperature in front of the turbine, by-pass ratio, and of nacelle drag on engine performance. Thrust and efficiency of the various configurations are discussed. The influence of a limited mixing chamber cross-section and of partial mixing is also analyzed. Author (ESA)

N81-20014# Technische Hochschule, Aachen (West Germany). Inst. fuer Strahlantriebe und Turboarbeitsmaschinen.
IDENTIFICATION OF JET ENGINE DAMAGES BY ENGINE TREND ANALYSIS LEADS 200 DATA
W. Koschel *In* DFVLR On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 153-181 refs In GERMAN; ENGLISH summary (For primary document see N81-20007 11-01)
Avail: NTIS HC A16/MF A01

N81-20015# Technische Hochschule, Aachen (West Germany). Lehrstuhl fuer Strahlantriebe und Turboarbeitsmaschinen.
SOME EFFECTS OF COMPRESSOR FOULING ON THE BEHAVIOR OF A TURBOJET ENGINE
H. Toenskoetter *In* DFVLR On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 183-218 refs In GERMAN; ENGLISH summary (For primary document see N81-20007 11-01)
Avail: NTIS HC A16/MF A01

N81-20016# British Airways, Middlesex (England).
USES OF AIDS DATA IN AIRLINES ENGINE MAINTENANCE
E. R. White *In* DFVLR On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 219-234 (For primary document see N81-20007 11-01)
Avail: NTIS HC A16/MF A01

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N81-20082*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AN ANALYTICAL STUDY OF THE LONGITUDINAL RESPONSE OF AIRPLANES TO POSITIVE WIND SHEAR
Windsor L. Sherman Mar. 1981 51 p refs
(NASA-TP-1765; L-13623) Avail: NTIS HC A04/MF A01 CSCL 01C

The longitudinal response of jet transport aircraft to vertical variation of the horizontal winds is analyzed. Specific reference is given to the role of the speed (u) stability derivatives in the interaction of the airplane and its environment. The relative importance of the u stability derivatives is determined. The wind shear tolerance factor is found which can be used to determine, in a qualitative manner, the stability (tolerance) of an airplane to wind shear. A further study of the control problem shows that the criteria for good control could be reduced from two to one automatic control systems. Only a speed control system is necessary for good control in wind shear. M.G.

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N81-20083*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OPERATING CHARACTERISTICS OF THE LANGLEY MACH 7 SCRAMJET TEST FACILITY
Robert W. Guy, Marvin G. Torrence, Alexander P. Sabol, and James N. Mueller Mar. 1981 56 p refs
(NASA-TM-81929; L-14174) Avail: NTIS HC A04/MF A01 CSCL 14B

Operating characteristics of the Langley Mach 7 Scramjet Test Facility are described. The facility is designed for testing

airframe integrated scramjet (supersonic combustion ramjet) engine models. Features include duplication of the flight Mach number total enthalpy, flight altitude simulation, and simulation of engine airframe integration effects such a bow shock wave precompression and boundary layer ingestion by the engine. Data obtained from facility calibration and from tests of a hydrogen burning, airframe integrated scramjet are discussed. An adverse interaction between the facility flow and the scramjet engine flow during combustion of the fuel is described. E.A.K.

N81-20084*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SUPPORT INTERFERENCE OF WIND TUNNEL MODELS: A SELECTIVE ANNOTATED BIBLIOGRAPHY

Marie H. Tuttle and Blair B. Gloss Mar. 1981 36 p
(NASA-TM-81909; L-14198) Avail: NTIS HC A03/MF A01 CSCL 14B

This bibliography, with abstracts, consists of 143 citations arranged in chronological order by dates of publication. Selection of the citations was made for their relevance to the problems involved in understanding or avoiding support interference in wind tunnel testing throughout the Mach number range. An author index is included. Author

N81-20085*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

COMMENTS ON SETTLING CHAMBER DESIGN FOR QUIET, BLOWDOWN WIND TUNNELS

I. E. Beckwith Mar. 1981 41 p refs
(NASA-TM-81948) Avail: NTIS HC A03/MF A01 CSCL 14B

Transfer of an existing continuous circuit supersonic wind tunnel to Langley and its operation there as a blowdown tunnel is planned. Flow disturbance requirements in the supply section and methods for reducing the high level broad band acoustic disturbances present in typical blowdown tunnels are reviewed. Based on recent data and the analysis of two blowdown facilities at Langley, methods for reducing the total turbulence levels in the settling chamber, including both acoustic and vorticity modes, to less than one percent are recommended. The pertinent design details of the damping screens and honeycomb and the recommended minimum pressure drop across the porous components providing the required two orders of magnitude attenuation of acoustic noise levels are given. A suggestion for the support structure of these high pressure drop porous components is offered. J.D.H.

N81-20086*# Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.

APPLICATION OF SUPERCONDUCTING COILS TO THE NASA PROTOTYPE MAGNETIC BALANCE Final Report, 1 Jan. 1977 - 31 Aug. 1980

C. W. Haldeman, R. A. Kraemer, S. W. Phey, M. M. Alishahi, and E. E. Covert Jan. 1981 144 p refs
(Grant NsG-1356)
(NASA-CR-165660; MIT-TR-207) Avail: NTIS HC A07/MF A01 CSCL 14B

Application of superconducting coils to a general purpose magnetic balance was studied. The most suitable currently available superconducting cable for coils appears to be a bundle of many fine wires which are transposed and are mechanically confined. Sample coils were tested at central fields up to .5 Tesla, slewing rates up to 53 Tesla/sec and frequencies up to 30 Hz. The ac losses were measured from helium boil-off and were approximately 20% higher than those calculated. Losses were dominated by hysteresis and a model for loss calculation which appears suitable for design purposes is presented along with computer listings. Combinations of two coils were also tested and interaction losses are reported. Two feasible geometries are also presented for prototype magnetic balance using superconductors. E.A.K.

N81-20087# ARO, Inc., Arnold Air Force Station, Tenn.

TWO-DIMENSIONAL ADAPTIVE-WALL EXPERIMENTS Final Report, Oct. 1979 - Sep. 1980

R. L. Parker, Jr. and W. L. Sickles AEDC Feb. 1981 55 p refs Sponsored by AF
(AD-A095199; AEDC-TR-80-63) Avail: NTIS HC A04/MF A01 CSCL 14/2

Experiments conducted in the Arnold Engineering Development Center (AEDC) Propulsion Wind Tunnel Facility Aerodynamic Wind Tunnel (1T) were part of a continuing program to develop adaptive-wall technology for the elimination of wall interference in transonic wind tunnels. The test section arrangement consisted of uniformly variable-porosity porous walls enclosed by a variable pressure plenum. Two subplena were attached to both the top and bottom walls in the region of the test model location. Two subplena locations were investigated. One location was established by test section boundary flow-angle criteria, and the other by test section boundary pressure criteria. The subplena location was shown to significantly affect the results. The test model was a six percent solid blockage, two dimensional NACA-0012 wing. The experiments were conducted for both lifting and nonlifting conditions including those conditions for which the supercritical flow regions extended to the test section boundary. GRA

N81-20088# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Flugsimulation.

A SIMPLE HYBRID VISUAL SIMULATION FOR RESEARCH FLIGHT SIMULATORS

Friedrich Erdmann and Echard Biertuempel Jul. 1980 62 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-690)
(DFVLR-Mitt-80-13) Avail: NTIS HC A04/MF A01

The basic theory of the system is described together with its realization with general purpose computers (digital-analog). The images generated consist of contourlines of the object. A contourline brightness control (depth screwing) is employed to produce a stereoscopic effect. The applicability of the method is demonstrated using runway, target and horizon symbols and combinations of these symbols. Various different scenarios can be simulated in this way. Author (ESA)

N81-20089# Royal Aircraft Establishment, Farnborough (England).

EXPERIMENTS USING A THREE-COMPONENT LASER-ANEMOMETRY SYSTEM ON A SUBSONIC FLOW WITH VORTICITY

J. B. Abbiss, P. R. Sharpe, and M. P. Wright London HMSO Jun. 1980 21 p refs
(RAE-TR-80081; RAE-IT-168; BR76036) Avail: NTIS HC A02/MF A01

Experiments with a three component laser anemometer on the wake and vortex structure behind a model wing at incidence in a 4 ft x 3 ft subsonic test section are described. Three colors from the output spectrum of an argon-ion laser were used for the three Doppler difference arrangements. The complete optical system operated in backscatter and was mounted on a single table which could be translated in three orthogonal directions. An integrated data acquisition and reduction system was used incorporating a photon correlator and a Honeywell 6/36 minicomputer. The output data consisted of mean velocity and turbulence intensity values for all three components at each measurement point. From these data, the mean velocity components in the directions of the conventional tunnel axes could be derived by means of a linear transformation. However, the measured turbulence intensities do not yield the turbulence intensities for these components without additional assumptions or supplementary information. Author (ESA)

N81-20090# National Academy of Sciences - National Research Council, Washington, D. C. Aeronautics and Space Engineering Board.

NATIONAL TRANSONIC FACILITY: A REVIEW OF THE OPERATIONAL PLAN Final Report

Hans W. Liepmann, Richard E. Black, Robert O. Dietz, Mark E. Kirchner, and William R. Sears Mar. 1980 26 p
(Contract NASw-2342)
(NASA-CR-163463; PB81-115289) Avail: NTIS HC A02/MF A01 CSCL 14B Avail: NTIS HC A02/MF A01 CSCL 14B

The proposed National Transonic Facility (NTF) operational plan is reviewed. The NTF will provide an aerodynamic test capability significantly exceeding that of other transonic regime wind tunnels now available. A limited number of academic research program that might use the NTF are suggested. It is concluded

that the NTF operational plan is useful for management, technical, instrumentation, and model building techniques available in the specialized field of aerodynamic analysis and simulation. It is also suggested that NASA hold an annual conference to discuss wind tunnel research results and to report on developments that will further improve the utilization and cost effectiveness of the NTF and other wind tunnels. GRA

N81-20091# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
FIDELITY OF SIMULATION FOR PILOT TRAINING
Dec. 1980 66 p refs
(AGARD-AR-159; ISBN-92-835-1377-0) Avail: NTIS HC A04/MF A01

The scope and effectiveness of current flight training in simulators was reviewed. The status of technologies and human behavior important to the fidelity of flight simulation were examined. Research objectives in the areas of simulation technologies and training that might lead to increased cost effectiveness in simulator training were identified. For individual titles, see N81-20092 through N81-20099.

N81-20092# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
FIDELITY OF SIMULATION FOR PILOT TRAINING. INTRODUCTION
In its Fidelity of Simulation for Pilot Training Dec. 1980 p 1-3 (For primary document see N81-20091 11-09)
Avail: NTIS HC A04/MF A01

Attention is focused on the subject of fidelity requirements for training simulators and background is provided for the multidisciplined community involved in developing these devices. Weaknesses in current methods of specifying training devices were identified, and a different approach is proposed. Gaps in the required technology were also identified, and appropriate research topics are suggested. It is hoped that, by establishing a dialog between the training community and the simulator technologists, these recommendations will lead to more cost effective devices. T.M.

N81-20093# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
PILOT TRAINING
In its Fidelity of Simulation for Pilot Training Dec. 1980 p 4-12 (For primary document see N81-20091 11-09)
Avail: NTIS HC A04/MF A01

Two problems in addressing the question of fidelity requirements for training simulators are discussed: the process whereby the effectiveness of the simulator within the training system is assessed, and the process whereby requirements are translated into simulator design requirements. It is shown that simulator design requirements should be based on more than obtaining a close replication of the aircraft. An alternative approach to the definition of simulator design requirements is presented. T.M.

N81-20094# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
PHYSIOLOGICAL FACTORS
In its Fidelity of Simulation for Pilot Training Dec. 1980 p 13-18 (For primary document see N81-20091 11-09)
Avail: NTIS HC A04/MF A01

The sensory mechanisms relevant to simulator motion fidelity were examined. A review of the literature concerning the influence of motion cues of various types, and of out-the-window (VFR) visual scenes, on pilot control strategies and performance. Nearly all of the studies involved continuous pilot control for tracking or disturbance regulation. In general, provision of motion cues, with or without wide-field vision, showed increasing utility for tasks requiring lead compensation, multi-axis control, smooth manipulation, and ample time for scanning alternate displays. T.M.

N81-20095# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
SIMULATION TECHNOLOGY
In its Fidelity of Simulation for Pilot Training Dec. 1980 p 19-30 (For primary document see N81-20091 11-09)
Avail: NTIS HC A04/MF A01

An assessment of existing simulation technology is presented. Those characteristics that could be expected to provide high perceptual fidelity are described, and it is shown where current limitations exist. Visual system technology and motion system technology are discussed. A review of fidelity considerations in crew stations and computer models is presented. T.M.

N81-20096# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
CONCLUSIONS AND RECOMMENDATIONS
In its Fidelity of Simulation for Pilot Training Dec. 1980 p 31-35 refs (For primary document see N81-20091 11-09)
Avail: NTIS HC A04/MF A01

Training requirements and objectives for pilot training were analyzed. The methods and facilities to perform the training are described along with: objective cues that would be experienced in the aircraft while performing the task being trained; the perceptual cues experienced by the pilot in the aircraft; the perceptual cues needed to train; and the hardware needed to provide the training cues. The development of simulator hardware and the validation of the simulator are discussed. T.M.

N81-20097# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
ASSESSMENT OF TRAINING EFFECTIVENESS
In its Fidelity of Simulation for Pilot Training Dec. 1980 p 36-41 refs (For primary document see N81-20091 11-09)
Avail: NTIS HC A04/MF A01

The present and future requirements for training simulators were examined. Training facilities are assessed as to their ability to train an aircrew and maintain their skills as effectively and economically as possible, while maintaining high standards of safety, efficiency, and personal confidence. Several training effectiveness models were reviewed. T.M.

N81-20098# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
PILOT ASSESSMENT OF TRAINING SIMULATORS
In its Fidelity of Simulation for Pilot Training Dec. 1980 p 48-53 refs (For primary document see N81-20091 11-09)
Avail: NTIS HC A04/MF A01

A survey of pilot opinions of existing training facilities is presented. European civil (Lufthansa, Swissair, KLM, and Fokker-VFW) and military (United Kingdom and Germany) facilities were assessed. The U.S. Airline Pilots' Association was surveyed to cover the civil simulators in the United States. T.M.

N81-20099# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
VISUAL SYSTEM TECHNOLOGY: STATUS AND PROBLEMS
In its Fidelity of Simulation for Pilot Training Dec. 1980 p 54-60 (For primary document see N81-20091 11-09)
Avail: NTIS HC A04/MF A01

A list is presented of visual factors relevant to aircraft operation. Some target values for these factors are presented which, while a degradation from the absolute characteristics of the real world and of human perception, if achieved would provide visual information indistinguishable in practice from reality. Four basic systems are discussed: computer-generated imagery; camera/modelboards; film (photographic); and shadowgraph. T.M.

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N81-20100*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
COMET SCIENCE WORKING GROUP REPORT ON THE HALLEY INTERCEPT MISSION
Nov. 1980 22 p refs
(NASA-TM-82386) Avail: NTIS HC A02/MF A01 CSCL 22A

The Halley Intercept Mission is described and the scientific

benefits expected from the program are defined. One characteristic of the mission is the optical navigation and resulting accurate delivery of the spacecraft to a desired point near the nucleus. This accuracy of delivery has two important implications: (1) high probability that the mass spectrometers and other in situ measurement devices will reach the cometary ionosphere and the zone of parent molecules next to the nucleus; (2) high probability that sunlit, high resolution images of Halley's nucleus will be obtained under proper lighting conditions. In addition an observatory phase is included during which high quality images of the tail and coma structure will be obtained at progressively higher spatial resolutions as the spacecraft approaches the comet. Complete measurements of the comet/solar wind interaction can be made around the time of encounter. Specific recommendations are made concerning project implementation and spacecraft requirements. M.G.

N81-20101*# California Univ., Los Angeles. School of Engineering and Applied Science.
ULTRAPURE METALS PREPARATION IN SPACE Final Report
P. Agarwal, R. F. Bunshah, and A. L. Bevolo (Ames Lab., Iowa) Jul. 1980 48 p refs
(Contract NAS8-33115)
(NASA-CR-161678; UCLA-ENG-8042) Avail: NTIS HC A03/MF A01 CSCL 22A

Purification studies were performed on vanadium, chromium and molybdenum using a two step vacuum melting/vacuum distillation process in the pressure range of 0.01 to 0.0001 Pa. Lower base pressure resulted in lower overall impurity content. Vanadium showed the best results out of the three metals studied and is a suitable candidate for future studies. Criteria for selection of candidate metals for future studies were identified and are reported. T.M.

N81-20102*# Rockwell International Corp., Downey, Calif. Space Operations and Satellite Systems Div.
SPAR 6 EXPERIMENT REPORT CONTAINERLESS PROCESSING OF GLASS EXPERIMENT 74-42 Progress Report
Ralph A. Happe 1 Mar. 1980 54 p refs
(Contract NAS8-32023)
(NASA-CR-161674; SSD-80-0045) Avail: NTIS HC A04/MF A01 CSCL 22A

Pertinent portions of the ground based research are described, including experiments leading to the selection of the flight sample composition: a silica modified gallia-calcia glass. Included are details of the preparation of an approximately .25 in diameter flight sample. T.M.

N81-20103*# National Aeronautics and Space Administration, Washington, D. C.
SARSAT: A RESCUE SYSTEM FOR SHIPS AND AIRPLANES
Oct. 1980 19 p refs Transl. into ENGLISH from "SARSAT, Ein Rettungssystem fuer Schiffe und Flugzeuge" Rept 80-054 (West Germany) 1980 p 1-14 Original language document was announced as A80-46302 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Erno Raumfahrttechnik G.m.b.H., Bremen
(Contract NASw-3199)
(NASA-TM-76391) Avail: NTIS HC A02/MF A01 CSCL 22A

The SARSAT rescue system is described and alternative systems discussed, with SARSAT functioning as either independent satellite within an emergency call system or as an additional search and rescue payload of another satellite system. Geostationary and polar orbits are compared. A low cost SARSAT rescue system utilizing four satellites in a quasi solar, sun synchronized orbit at 1000 kilometers is proposed. Three multiple start satellites in a 57 degree orbit, with a fourth satellite in reserve at a lower orbit are described. Alternative transport systems are discussed and a recommended time table from project approval to launch is given. J.D.H.

N81-20104# Canadian Astronautics Ltd., Ottawa (Ontario).
STUDY ON THE COMPATIBILITY OF SURSAT AND LASS/COMSS TECHNICAL MISSION REQUIREMENTS Final Report
William E. Cox Paris ESA 22 Oct. 1979 116 p refs
(Contract ESA-3951/79/F-DKR(SC))
(CAL-79/91-1; ESA-CR(P)-1379) Avail: NTIS HC A06/MF A01

Coverage requirements and instrument operations profiles of the two systems were studied. Mission requirements were reviewed including the parameters for the Synthetic Aperture Radar (SAR) optical imaging sensors, and imaging microwave radiometer. Coverage cycle selection criteria, including spacing between subsatellite tracks, local mean time of passage and solar elevation angles are discussed. Coverage patterns for both systems are shown. The prime area in which SURSAT and LASS/COMSS were analyzed and the most promising area for potential limited improvements, is SAR. Author (ESA)

N81-20105# Techno System Developments, Naples (Italy).
STUDY ON FLUID PHENOMENA INFLUENCING THE DESIGN OF ZERO-GRAVITY EXPERIMENTS, VOLUME 1 Final Report
Paris ESA Jan. 1980 95 p refs 2 Vol.
(TS-1-80-Vol-1; ESA-CR(P)-1386-Vol-1) Avail: NTIS HC A05/MF A01

Field equations for volume and surface phase are formulated in vectorial form and subsequently written in the parallel-surface coordinate system appropriate for the further development of the analyses. The nondimensional process is described and discussed. The order of magnitude analysis is then developed wherein all statements, rules and results given in the Users Guide are proven. The proper design of zero-gravity materials science experiments is then considered and their evaluation is outlined. Author (ESA)

N81-20106# Techno System Developments, Naples (Italy).
STUDY ON FLUID PHENOMENA INFLUENCING THE DESIGN OF ZERO-GRAVITY EXPERIMENTS. VOLUME 2: USERS' GUIDE
Paris ESA Dec. 1979 127 p refs 2 Vol.
(TS-11-79-Vol-2; ESA-CR(P)-1386-Vol-2) Avail: NTIS HC A07/MF A01

Results of a nondimensional and an order of magnitude analysis for problems of interest in materials science experiments are summarized. The expression for the residual gravitational vector is given together with a list of forces acting on a fluid in a microgravitational environment. The physical properties of fluids and of the interfaces which influence a flow field are also presented. A representative group of 46 liquids is cited. Hydrostatics and fluid dynamics are dealt with. Thermal Marangoni flow is defined, and the possible velocity and temperature regimes are described. Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N81-20107*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
STUDY OF CERTAIN LAUNCHING TECHNIQUES USING LONG ORBITING TETHERS Final Technical Report, 1 Jul. 1980 - 28 Feb. 1981
Giuseppe Colombo and David A. Arnold Mar. 1981 24 p refs
(Grant NAG8-008)
(NASA-CR-164060) Avail: NTIS HC A02/MF A01 CSCL 22A

A study of the basic equations governing orbital transfers using long orbiting tethers is presented. A very simple approximation to the general transfer equation is derived for the case of short tethers and low eccentricity orbits. Numerical examples are calculated for the case of injection into a circular orbit from a platform in eccentric orbit and injection into eccentric orbit from a platform in circular orbit. For the case of long tethers, a method is derived for reducing tether mass and increasing payload mass by tapering the tether to maintain constant stress per unit of tether cross section. Formulas are presented for calculating

the equilibrium orbital parameters taking into account the mass of the platform, tether, and payload. E.D.K.

N81-20108# Centre National d'Etudes Spatiales, Paris (France).
SPACE VEHICLE ORBITAL MOTION [LE MOVEMENT DU VEHICLE SPATIAL EN ORBITE]
1980 1061 p refs In FRENCH Proc. of CNES Cours de Technol. Spatiale, Toulouse, 2-13 Jun. 1980
(ISSN-0244-8041) Avail: NTIS HC A99/MF A01

Topics covered include celestial mechanics, orbit calculation, and orbit determination from position measurements. Spacecraft attitude control, orbit correction, and injection are discussed in terms of hardware as well as theoretically. Interplanetary missions are considered. Problems arising from atmospheric reentry are treated and experience gained through the reentry of Skylab is commented on. For individual titles, see N81-20109 through N81-20141.

N81-20109# Ecole Nationale Superieure de l'Aeronautique, Toulouse (France).
BASIC NOTIONS IN RATIONAL MECHANICS AND APPLICATIONS TO SPACE MECHANICS [ELEMENTS DE BASE DE MECANIQUE RATIONELLE ET APPLICATIONS A LA MECANIQUE SPATIALE]
D. Bellet *In* CNES Space Vehicle Orbital Motion 1980 p 3-57 refs In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

Classical, rational mechanics based on Galileo-Newtonian approximation are assessed for application to the determination of the trajectory of a body in space and of its different motions along the trajectory. Two problems are posed: given the movement of a known of a known physical system, find the forces which interact; and reciprocally, given the causes of interaction in a system, predict the motion of the system. Two methods of treating these problems are presented. One uses general theorems, deduced from classical mechanics, which characterize movement in space. The second is derived from the law of elementary virtual forces and leads to the Lagrange formalism of analytic mechanics. The analysis describes small oscillations of a body and their stability. The approach is simplified by the linearization of the complete equations of motion. Keplerian movement of a body in space governed by the laws of universal attraction is used to illustrate both methods. Author (ESA)

N81-20110# Centre National d'Etudes Spatiales, Toulouse (France). Groupe de Recherches de Geodesie Spatiale.
PERTURBED ELLIPICAL MOTION [LE MOUVEMENT ELLIPTIQUE PERTURBE]
G. Balmino *In its* Space Vehicle Orbital Motion 1980 p 59-84 In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

The movement of an orbital satellite and of the Earth is described as two point bodies, isolated in space and attracting each other according to Newton law. The trajectory is closed, elliptical, and governed by Kepler laws. The principal perturbations are enumerated and the equations of motion are treated for the generalized case, i.e., Gauss equations. Another form of these equations, resulting when the perturbation forces are derived in function of conservative forces, i.e., Lagrange equations, is then considered. Conservative perturbation forces due to the presence of a third body (Moon or Sun) and those resulting from variations in the Earth gravitational potential are examined and the respective perturbation functions are clarified. Author (ESA)

N81-20111# Centre National d'Etudes Spatiales, Toulouse (France). Groupe de Recherches de Geodesie Spatiale.
SPACE AND TIME REFERENCE SYSTEMS [LES REPERES DE L'ESPACE ET DU TEMPS]
F. Nouel *In its* Space Vehicle Orbital Motion 1980 p 85-102 ref In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

Coordinate systems used to represent satellite position measurements are examined and transformations into inertial reference systems which are used in the integration of the equations of motion for a satellite in order to determine its trajectory, are shown. Reference systems common to space geodesy are emphasized. The determination of ground station position as a corollary to satellite trajectory analysis is discussed. Problems of time scale which arise with comparison of nonsimultaneous measurements of different points on the globe as well as with time dependent analysis of certain kinematic and dynamic phenomena are also covered. Author (ESA)

N81-20112# Centre National d'Etudes Spatiales, Toulouse (France).
ORBIT PERTURBATION: CAUSES AND REPRESENTATION [LES PERTURBATIONS D'ORBITE. LES CAUSES; LEUR REPRESENTATION]
D. Vienne *In its* Space Vehicle Orbital Motion 1980 p 105-130 In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

Force fields of various types which affect and perturb satellite orbits are studied. Mathematical formulations of the different types of forces are deduced and the physics of the phenomena are interpreted. The means necessary for representing these forces are discussed including measurements, computerized models and calculation methods. The relative importance of the several forces, ranked proportionally taking the Earth's attraction to be 1, is shown. Author (ESA)

N81-20113# Centre National d'Etudes Spatiales, Toulouse (France). Groupe de Recherches de Geodesie Spatiale.
ORBIT PERTURBATIONS: THE EFFECTS [LES PERTURBATIONS D'ORBITE; LES EFFETS]
N. Borderies *In its* Space Vehicle Orbital Motion 1980 p 131-158 refs In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

The two body problem of a satellite in an elliptical orbit around the Earth is studied. The position of the satellite in its orbit is defined in terms of its true anomaly. Keplerian movement is assumed and the dynamic state of the satellite is characterized using celestial coordinates. Six orbital elements are given as differential equations varying in time. A simplified perturbation theory is elaborated from the integration of these equations to determine the movement of the satellite. The most important perturbation phenomena are identified and the significance of the terms is derived. Effects due to the term J sub Z in the geopoential, resonances, and the aerodynamic drag of the atmosphere influence the satellite in that order. Author (ESA)

N81-20114# Centre National d'Etudes Spatiales, Toulouse (France). Groupe de Recherches de Geodesie Spatiale.
EXTRAPOLATION OF ORBITS [EXTRAPOLATION D'ORBITE]
N. Borderies *In its* Space Vehicle Orbital Motion 1980 p 159-177 refs In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

The use of analytic theory, numerical integration, or a mixed method in the extrapolation of a spacecraft orbit is shown to depend on mission requirements. Parameters to be extrapolated for the ARGOS satellite system, for SPOT satellite, DZB satellite, and for geostationary satellites are among examples cited. Orbit extrapolation for SKYLAB reentry is also covered. Analytic methods include integration of the Lagrange and Gauss equations as well as coordinate transformations. Numerical techniques described are the Adams-Moulton-Cowell method and an elaborated version. An approximation algorithm which finds the osculatory elements in then demonstrated. The advantages and inconveniences in applying each method are summarized. Author (ESA)

N81-20115# Centre National d'Etudes Spatiales, Toulouse (France).
MEASUREMENT FOR ORBIT DETERMINATION [LES MESURES EN ORBITOGRAPHIE]
A. Cariou *In its* Space Vehicle Orbital Motion 1980 p 179-200 In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

Different types of measurements and the techniques employed to obtain them are discussed. Angular measurement based on satellite tracking antenna direction, on simultaneous dual interferometry, or on examination of photographs of spacecraft against a star field is considered as well as both distance and Doppler measurement. Geometrical characteristics and the representative measurable physical quantities are identified for

each measurement type. The magnitude of respective interpretation problems is shown analytically. Author (ESA)

N81-20116# Centre National d'Etudes Spatiales, Toulouse (France).
ORBIT DETERMINATION: STATISTICAL METHODS [RESTITUTION D'ORBITE. LES METHODES STATISTIQUES]
P. Legendre *In its* Space Vehicle Orbital Motion 1980 p 201-225 In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

The problem of finding a satellite trajectory from position and/or velocity measurements taken at a given instant in time is examined. A trajectory evolution model including a random vector which represents measurement error is presented. Assuming an iterative approach, the problem is linearized using a previous orbital position estimation. The least squares method is considered in terms of the linear model, approximation in Euclidean space, and for the calculation power of a minimum variance estimator and a maximum likelihood estimator. The Kalman method is then studied and aspects of Bayesian statistics and calculation using a discrete Kalman filter are shown. In application, algorithms based on both least squares and Kalman methods are developed for orbit determination. Author (ESA)

N81-20117# Centre National d'Etudes Spatiales, Toulouse (France).
ORBIT CALCULATION PROGRAMS [LOGICIELS DE CALCUL D'ORBITE]
D. Vienne *In its* Space Vehicle Orbital Motion 1980 p 227-243 In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

The design of a computer system for orbit calculation, especially for ground based spacecraft guidance applications, is considered, correlating mission requirements with available data processing resources. Memory capacity, run time, calculation precision, and operational problems, such as file maintenance and intermachine communication, are covered. Functional criteria include choice of orbit type, analysis of principal forces as well as perturbations, and definition of needed measurements for trajectory determination. Problems arising when new requirements must be integrated with existing facilities are also mentioned. Author (ESA)

N81-20118# Centre National d'Etudes Spatiales, Toulouse (France).
GENERALITIES AND DEFINITION OF A SYSTEM [GENERALITES ET DEFINITION DU SYSTEME]
J. J. Runavot *In its* Space Vehicle Orbital Motion 1980 p 247-288 In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

Passive stabilization of satellite attitude is described, using rational mechanics and angular dynamics theory. An appropriate system for command of attitude and orbit is defined and modeled mathematically. An inertial reference system is presented and coordinate transformations from basic elements to satellite elements, accommodating the expression of Euler and Cardan rotations, is shown. Kinematic equations for the change in attitude under the effects of respective angular velocity are expressed for the pitch, roll and yaw axes. Simplified equations of motion around a center of mass are then written in vectorial form. The formulated model is studied for inertial actions, actions due to gravity, and for coupling effects with exterior forces. Aerodynamic drag, magnetic field coupling, and solar radiation pressure are emphasized. Passive stabilization systems are classified. Stabilizations by rotation, and by the gravity gradient are demonstrated. Author (ESA)

N81-20119# Centre National d'Etudes Spatiales, Toulouse (France).
ATTITUDE AND ORBIT COMMAND [COMMANDE D'ATTITUDE ET D'ORBITE]
P. Duchon *In its* Space Vehicle Orbital Motion 1980 p 289-314 In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

Active satellite stabilization is discussed for two types of attitude and orbit control systems: spin stabilization, and three axes stabilization. The METEOSAT, TELECOM 1, and SPOT satellite systems are cited as illustrations. Gyroscopic (spin) stabilization is described mathematically, accounting for the evolution of attitude and nutation. The METEOSAT nutation dampers, pencil type IR attitude sensors, as well as the respective command and active control systems are depicted. Attitude measurement for three axes stabilization is elaborated, covering both optical and inertial sensors. Application to attitude command is summarized and three axes stabilization systems which either make use of onboard kinetic moment (TELECOM 1) or do not (SPOT) are modeled by equations of attitude. A synoptic overview of the SPOT attitude command system is shown. Author (ESA)

N81-20120# Centre National d'Etudes Spatiales, Toulouse (France).
PRINCIPLES AND SENSORS FOR ATTITUDE MEASUREMENT [LA MESURE D'ATTITUDE. LES PRINCIPES, LES SENSEURS]
P. Duchon and M. P. Vermande *In its* Space Vehicle Orbital Motion 1980 p 315-348 In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

Methods and instrumentation used for satellite attitude determination are surveyed. Elements which characterize attitude measurement are listed, including reference points, spacecraft motion, functional specifications, and the choice of measurement subsystem. The various possible reference points are studied, bringing out their advantages and disadvantages. Different detectors discussed include optical (visible and IR) devices, magnetic field sensors, and gyroscopic accelerometers. Examples of attitude acquisition cover the use of solar sensors, stellar sensors, Earth sensors, and inertial detectors. The combination of sensors in a system which determines overall attitude is considered, with emphasis on the SPOT satellite attitude measurement system and a system which incorporates CCD star trackers with gyrometers. Author (ESA)

N81-20121# Centre National d'Etudes Spatiales, Toulouse (France).
ACTUATORS [LES ACTUATEURS]
J. Maquet *In its* Space Vehicle Orbital Motion 1980 p 349-373 refs In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

Actuators for attitude control as well as for on-station orbital corrections are reviewed. Two types of satellite equipment are considered: (1) thrusters which generate forces by varying the quantity of mass ejected into space, and (2) inertia wheels, either of the kinetic or reaction type, which provide torque by momentum transfer to the satellite structure. The concept specific impulse is defined, leading to the characterization of the most common chemical and electric thrusters. The problem of storage and use of liquid fuels under weightless conditions is also summarized. The advantages and disadvantages of inertia wheels are discussed. Bearing technology relative to their use is emphasized. Author (ESA)

N81-20122# Centre National d'Etudes Spatiales, Toulouse (France).
ATTITUDE DETERMINATION [RESTITUTION D'ATTITUDE]
J. Foliard *In its* Space Vehicle Orbital Motion 1980 p 375-414 In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

Different possibilities for attitude determination, using ground based computers, are examined relative to mission type, i.e., rotating satellite, gravity gradient satellite, and satellites in low altitude or transfer orbits. The analytical principles of attitude determination are given. Static methods are described and calculations for a spin stabilized satellite in a transfer orbit are shown, deriving the direction of the axis of rotation. Dynamic methods of attitude determination are then developed for Poinsot motion. The special case of a model of motion for gravity gradient stabilization follows. Computer systems organization catering to attitude programs is illustrated and real time requirements arising from attitude maneuvers are discussed. Author (ESA)

N81-20123# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).

SPACECRAFT LAUNCHING [FONCTIONNEMENT DES FUSEES PORTEUSES]
M. F. Duret *In* CNES Space Vehicle Orbital Motion 1980 p 417-428 In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

A generalized approach to launch vehicle parameterization in function of desired mission goals, and the principal factors affecting rocket performance are described. Forces acting on the rocket are limited to propulsion system thrust, resultant aerodynamics, and Newtonian attraction of the Earth. A law of launch vehicle command is formulated and simplified equations of motion are expressed. Characteristic velocities are obtained and losses are examined analytically. Results are used in determining the number of rocket stages necessary. As examples of placing a satellite in orbit, ARIANE and DIAMANT trajectories are analyzed. The influence of launch site latitude and launcher azimuth is shown goemetrically. Author (ESA)

N81-20124# Centre National d'Etudes Spatiales, Paris (France).
LAUNCH SYSTEMS FOR THE 1980'S [LES SYSTEMS DE LANCEMENT DE LA DECENNIE 80-90]
M. Gilli *In its* Space Vehicle Orbital Motion 1980 p 429-472 In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

Launch systems operational January 1, 1980 are surveyed. These comprise United States, Japanese, Soviet, and Chinese launch vehicles. An Indian launch vehicle which may become operational this decade is also mentioned. The space transportation system and ARIANE launch system are then reviewed, pointing out payload delivery capacities and cost competitive characteristics. Data sheets, showing vehicle configuration characteristics, propulsion system specifications, stabilization and guidance method, performance and cost, are provided for each launch system considered. Author (ESA)

N81-20125# Centre National d'Etudes Spatiales, Paris (France).
USING THE ARIANE LAUNCH VEHICLE [UTILISATION DU LANCEUR ARIANE]
J. P. Dulout *In its* Space Vehicle Orbital Motion 1980 p 473-485 In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

The various studies which must be undertaken in order to verify if the ARIANE launch system is adapted to given mission requirements are reviewed. The ARIANE user manual is summarized, emphasizing launch vehicle performance and satellite orientation capabilities. Mission planning, i.e., trajectory calculation, and satellite attitude acquisition following separation, is discussed. The preparation of a flight program is outlined and digital as well as analog simulation tests which verify flight program integrity are mentioned. Author (ESA)

N81-20126# Centre National d'Etudes Spatiales, Toulouse (France).
SPACE MISSIONS AND ORBIT/ATTITUDE SYSTEMS [MISSIONS SPATIALES ET SYSTEMES ORBITE/ATTITUDE]
J. L. Pieplu *In its* Space Vehicle Orbital Motion 1980 p 489-503 refs In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

Different types of space missions are categorized and orbit/attitude control systems are reviewed, emphasizing their evolution. As examples of mission requirements dictating stabilization system design, telecommunications satellites (TELECOM 1) and Earth observation satellites (SPOT) are singled out. The TELECOM 1 mission objectives are summarized, justifying the choice of a geostationary orbit, three axes stabilization, and hydrazine thrusters for making corrections. Similarities with other satellite systems (SYMPHONIE; OTS; ECS) are also mentioned. The SPOT mission is analyzed in terms of Earth observation contraints, i.e., spatial resolution, geographic area to be covered, repetition of observations, etc. Optimal orbit calculation is discussed and the attitude control system is briefly described. Author (ESA)

N81-20127# Centre National d'Etudes Spatiales, Toulouse (France).
POSITIONING A GEOSTATIONARY SATELLITE [SATELLITE GEOSTATIONNAIRE: MISE A POSTE]
J. M. Robert and J. Foliard *In its* Space Vehicle Orbital Motion 1980 p 505-581 refs In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

All the operations necessary for a satellite to pass from its initial orbit to its final geosynchronous orbit are discussed as well as the orbit physical constraints arising from them, including the choice of launch windows. Differences in operating procedures, depending on whether the satellite is spin stabilized or three axis stabilized, are detailed for the transfer orbit phase. The minimum incremental velocity required for positioning, the correction for inclination, the correction for eccentricity, and the derived orbit correction are calculated. Results lead to the optimization of the transfer orbit and optimization of positioning maneuvers. The special case of two satellites launched simultaneously by the same launched vehicle (ARIANE SYLDA nosecone) is discussed and the orbit calculations are clarified. Problems inherent to satellite separation from launch vehicle third stage are posed and a mathematical definition is offered. Author (ESA)

N81-20128# Centre National d'Etudes Spatiales, Toulouse (France).
GEOSTATIONARY SATELLITE STATIONKEEPING. ORBIT PERTURBATION [MAINTIEN A POSTE DES SATELLITES GEOSTATIONNAIRES. 1: EVOLUTION DE L'ORBITE]
P. Legendre *In its* Space Vehicle Orbital Motion 1980 p 583-609 In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

Perturbation effects on the orbit of a geostationary satellite are described mathematically. Orbit corrections of sufficiently brief duration are considered as impulses. The analysis is restricted to three phenomena affecting the natural evolution of the orbit are analyzed: (1) variation in inclination due to lunar-solar attraction; (2) variation in the major axis and in the mean longitude as an effect of the tesseral terms for the geopotential; and (3) variation in eccentricity due to solar radiation pressure. Disturbing functions are written and characteristics of secular perturbation are derived. Calculation of impulse corrections is demonstrated in vectorial form. Author (ESA)

N81-20129# Centre National d'Etudes Spatiales, Toulouse (France).
GEOSTATIONARY SATELLITE STATIONKEEPING: ORBIT CORRECTION STRATEGIES [MAINTIEN A POSTE DES SATELLITES GEOSTATIONNAIRES. 2: STRATEGIE DES CORRECTIONS D'ORBITE]
P. Legendre *In its* Space Vehicle Orbital Motion 1980 p 611-625 In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

The optimization of a correction strategy for maintaining a geostationary satellite on station is formulated as a minimization problem under constraints, i.e., minimize Q(X) with X being an element of D, where X is a vector made up of correction dates and the components of the different impulses. The domain D is defined by the objectives of stationkeeping and by constraints relative to mission operation. The notion of strategy is reviewed, and conclusions are synthesized towards the elaboration of an appropriate strategy. Elaboration involves applying the strategy to a simplified model of orbit evolution, adjusting it to better approach reality, then evaluating it using numerical simulation. Various strategies are analyzed and those variables which dictate the choice of a strategy are identified. Author (ESA)

N81-20130# Centre National d'Etudes Spatiales, Toulouse (France).
A SCANNING SATELLITE. MAINTAINING THE ORBIT. SPOT [SATELLITE A DEFILEMENT: MAINTIEN DE L'ORBITE. SPOT]
Brigitte Serreault *In its* Space Vehicle Orbital Motion 1980 p 267-658 refs In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

Taking the SPOT satellite as an example, the choice of orbit is discussed. The use of a phased heliosynchronous orbit is justified by the need for similar lighting during each scanner pass. The evolution of this type of orbit under various perturbation effects is modeled mathematically and results are used to calculate

optimum initial inclination and initial eccentricity. The control of phase is explained analytically and the theoretical delay between two corrections is derived. The model is applied to simulated phase control, with degradation uniquely due to atmospheric drag. Author (ESA)

N81-20131# Centre National d'Etudes Spatiales, Toulouse (France).
CHOICE AND ACQUISITION OF THE SPOT SATELLITE ORBIT [ACQUISITION ET CHOIX DE L'ORBITE SPOT]
M. Courtois and B. Serreault *In its* Space Vehicle Orbital Motion 1980 p 659-701 refs In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

Parameters of the SPOT satellite nominal orbit as well as of its initial orbit are reviewed, emphasizing time equations for fixing the moment of passage through the descending node. The problem of specular reflection and its influence on the SPOT sensor system is considered. Parametric errors introduced by variations in launch vehicle performance are then studied for their influence on initial injection, and the principal of attitude correction is clarified in vectorial form. Transfer orbit and final orbit acquisition constraints, particular to the SPOT satellite, are examined as well as the sequence of operations leading to attitude and orbit acquisition. Author (ESA)

N81-20132# Centre National d'Etudes Spatiales, Toulouse (France).
THE EXCHANGE OF INFORMATION BETWEEN A SATELLITE AND THE GROUND FOR CONTROL OPERATIONS, AND STARTING UP THE GROUND SYSTEM [L'ECHANGE ENTRE LE SATELLITE ET LE SOL DES INFORMATIONS POUR LES OPERATIONS DE CONTROLE ET LA MISE EN OEUVRE DU SYSTEME SOL]
Gilbert Cales *In its* Space Vehicle Orbital Motion 1980 p 703-782 refs In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

Ground station satellite control networks and associated communication systems are described, emphasizing application to satellite attitude and orbit control. Various satellite-ground control links are characterized by the frequencies used, and operational standards of telemetry and remote control are reviewed. The influence of orbit and attitude on the qualification of a radio link is shown. A generalized network is then presented, including schematics of station equipment. The data transmission system is explained and the importance of communication with the mission control center is brought out. As examples, the CNES, ASE, and INTELSAT systems are mentioned, while the NASA STDN network is shown in detail. The starting up of a ground control system is analyzed, underlining the necessity of adequate operations documentation which defines mission objectives as well as equipment parameters. Author (ESA)

N81-20133# Centre National d'Etudes Spatiales, Toulouse (France).
GROUND EQUIPMENT FOR MOVING SATELLITES AND GEOSTATIONARY SATELLITES [LES MOYENS SOL POUR LES SATELLITES A DEFILEMENT ET GEOSTATIONNAIRES]
D. Levy *In its* Space Vehicle Orbital Motion 1980 p 783-813 In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

Computer techniques used in a mission control center as well as the operations undertaken by the center are described. Using TELECOM operations planning as an illustration, the various tasks immediately following injection and comprising the operational phase of satellite lifetime are discussed. The interface between the control center and other ground segment equipment is explained. The computer systems programming and the work done by the data processing center which assures the operation and control of the satellite are emphasized. Control center functional design is then considered in terms of generalized constraints posed by specific satellite type and mission objectives. Author (ESA)

N81-20134# Centre National d'Etudes Spatiales, Toulouse (France).
METHODS OF LOCALIZATION BY SATELLITES IN THE ARGOS SYSTEM [METHODES DE LOCALISATION PAR SATELLITE DANS LES SYSTEMS ARGOS]
A. Cariou *In its* Space Vehicle Orbital Motion 1980 p 815-845 In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

A system for localization and data collection by satellites (ARGOS) is presented. The space segment of the system is presently on board the TIROS N and NOAA-A satellites. The ARGOS system is based on the processing of Doppler measurements, made on board a satellite, of radio signals from beacons provided by the user. The dating, orbital position estimation, and localization functions of ARGOS are explained mathematically. The operational performance of the localization system is then reviewed. Error sources are analyzed and the accuracy of the system is determined, given actual test measurements. Author (ESA)

N81-20135# Bureau des Longitudes, Paris (France).
THE SOLAR SYSTZM [LE SYSTEME SOLAIRE]
B. Morando *In* CNES Space Vehicle Orbital Motion 1980 p 849-858 refs In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

The solar system is described in terms of the physical characteristics of the various celestial bodies, while the physics governing their motion is explained. A generalized expression for the potential of the planets is given. The natural satellites of the planets, including the moon, are discussed. The asteroids and comets are also covered. The representation of motion in the solar system is explained. Application of Kepler's third law in determining mass and orbit is then shown. Finally, the rotations of the different planets are treated. Author (ESA)

N81-20136# Centre National d'Etudes Spatiales, Toulouse (France).
THE CALCULATION OF INTERPLANETARY TRAJECTORIES [LE CALCUL DE TRAJECTOIRES INTERPLANETAIRES]
A. Perret *In its* Space Vehicle Orbital Motion 1980 p 859-896 refs In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

Numerical techniques for determining spacecraft motion within the solar system are reviewed. Generalized equations of motion are presented both for movement in an inertial reference system and for movement in a reference system centered on a body. Terms for gravitational and for non-gravitational forces are given. Integration methods for the equations are compared and principal causes of errors are identified. The propagation of trajectories is explained, using the notion of spheres of influence. The method of juxtaposed conics is shown. Problems in setting initial and final conditions for interplanetary rendezvouses are then considered for various transfer criteria. Calculation of a swingby trajectory is also covered. As alternatives to the method of juxtaposed conics as well as to numerical integration for trajectory computation, either a multiconic method, an asymptotic method, a method of virtual center of mass, or use of the Jacobi integral is suggested for specific cases. Author (ESA)

N81-20137# European Space Operations Center, Darmstadt (West Germany).
INTERPLANETARY ORBIT CONTROL [LE CONTROLE D'ORBITE INTERPLANETAIRE]
E. A. Roth *In* CNES Space Vehicle Orbital Motion 1980 p 897-907 refs In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

In the context of interplanetary navigation, spacecraft position determination and the necessary correction maneuvers are described mathematically. Position measurements and sources of errors are discussed briefly, leading to a dynamic model of random accelerations which influence spacecraft trajectory. The dynamic system is determined by a stochastic differential equation. A linearized equation of observation is also introduced. The transition matrix is evolved in Jacobi matrix form. Correction maneuvers are then evaluated for the deviation of the observed state vector of the reference orbit at a given time. Both a fixed time of arrival and a variable time of arrival are considered.

Finally, computer programming which handles orbit calculation and position determination is treated. Author (ESA)

N81-20138# Centre National d'Etudes Spatiales, Toulouse (France).
INTERPLANETARY MISSIONS: UPCOMING TECHNOLOGICAL ASPECTS [MISSIONS INTERPLANETARIES: ASPECT TECHNOLOGIQUE, PROSPECTIVE]
J. J. Runavot *In its* Space Vehicle Orbital Motion 1980 p 909-927 refs In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

Characteristics particular to attitude and orbit command systems on board interplanetary probes are reviewed, emphasizing constraints imposed by mission requirements. Associated operational problems, such as attitude detector versatility, the generation of torque, and propulsion system efficiency, are then examined. The development of propulsion systems is considered and expressions for evaluating specific impulse are given. Two low thrust propulsion systems (solar electric thrustors; solar sails) are studied and the technological outlook for their use is analyzed. Author (ESA)

N81-20139# Centre d'Etudes et de Recherches Geodynamiques et Astronomiques, Grasse (France).
MODELS OF THE UPPER EARTH ATMOSPHERE. APPLICATION TO SATELLITE TRAJECTORY DETERMINATION [MODELES DE LA HAUTE ATMOSPHERE TERRESTRE. APPLICATION A LA TRAJECTOGRAPHIE DES SATELLITES]
M. F. Barlier *In* CNES Space Vehicle Orbital Motion 1980 p 931-940 refs In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

Calculation of atmospheric drag on a satellite, based on an atmospheric model of density in function of height and temperature, is discussed. A drag, temperature model which combines a thermopause temperature model with an atmospheric component concentration model (at 120 km) is presented. The mathematical representation is of the spherical type. Variations in the model parameters are then assessed for solar activity cycles, fluctuations in geomagnetic activity, and the effect of longitude. Results are compared with density measurements made with the CACTUS accelerometer and agree (+ or - 20%) satisfactorily. Author (ESA)

N81-20140# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SPACE VEHICLE ATMOSPHERIC REENTRY TRAJECTORIES [TRAJECTOIRES DE RENTREE DANS L'ATMOSPHERE DE VEHICULES SPATIAUX]
J. Fave *In* CNES Space Vehicle Orbital Motion 1980 p 941-792 In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

Orbit calculation results concerning atmospheric reentry of various types of spacecraft are presented. Specifically, laws governing the motion of these vehicles are indicated, and generalized relationships between motion parameters and resultant performances are given in analytic form. A reentry trajectory is decomposed into two parts: the orbital arc, and the atmospheric arc. The orbital arc is studied for particularities arising during transfer from a low altitude circular orbit. The concept 'reentry corridor' is also covered. General equations for the atmospheric arc are shown, and the Chapman-Vinh solution, the Saenger solution (balanced trajectory), and Eggers solution (first ricochet) are illustrated. Author (ESA)

N81-20141# Centre National d'Etudes Spatiales, Toulouse (France).
NATURAL REENTRY OF SATELLITES: SKYLAB [RENTREE NATURELLE DES SATELLITES: SKYLAB]
J. M. Robert *In its* Space Vehicle Orbital Motion 1980 p 973-1017 In FRENCH (For primary document see N81-20108 11-13)
Avail: NTIS HC A99/MF A01

The calculations undertaken as part of the French effort in the final tracking of Skylab are discussed. The radar and optical tracking system is briefly described and the quality of measurements is assessed. The Skylab orbit during the last eight days before impact is analyzed. The atmospheric model used in making orbit predictions is cited and the reentry prediction algorithm is given in detail. Orbit determinations are used to identify the mean aerodynamic coefficient in function of height which represents the rate of orbit decay for the period. Results are shown as predictions of the Skylab ground tracks. Author (ESA)

N81-20142# Royal Aircraft Establishment, Farnborough (England).
ANALYSES OF THE US NAVY ORBITS OF 1963-24B AND 1974-34A AT 15TH ORDER RESONANCE
Doreen M. C. Walker London HMSO Jul. 1980 30 p refs (RAE-TR-80093; RAE-Space-584; BR76042) Avail: NTIS HC A03/MF A01

The orbits of the two satellites 1963-24B (TIROS 7 rocket, at inclination 58.2 deg) and 1974-34A (INTERCOSMOS 11, at inclination 50.6 deg) passed slowly through 15th order resonance within 6 months of each other in 1976 to 77. The changes in their orbital inclinations and eccentricities were analyzed, using 112 weekly US Navy orbits for 1963-24B and 129 for 1974-34A. The analysis yields 16 values of lumped harmonic coefficients, 12 of 15th order and four of 30th order. Sixteen equations are given for these lumped harmonics in terms of the individual coefficients or order 15 and 30, for use in a future determination of the individual coefficients. The lumped harmonic coefficients obtained from the two satellites are compared with the corresponding values from the latest Goddard Earth Model (GEM 10C). The agreement is very satisfactory. Author (ESA)

N81-20143# Centre National d'Etudes Spatiales, Toulouse (France). Dept. Mathematiques et Mecanique Spatiales.
THE REENTRY OF SKYLAB: REENTRY TRACKING AND ORBIT CALCULATION [SKYLAB. SUIVI DE LA RENTREE DU POINT DE VUE CALCUL D'ORBIT]
J. P. Carrou, J. M. Robert, D. Vienne, F. Barlier, and R. Futaully Jul. 1979 131 p refs In FRENCH Report will also be announced as translation (ESA-TT-688)
(CNES-CT/EMT/MT/MS/208) Avail: NTIS HC A07/MF A01

The calculations undertaken as part of the French effort in the final tracking of Skylab are discussed. The radar and optical tracking system is described and the quality of measurements is assessed. The Skylab orbit during the last eight days before impact is analyzed. The atmospheric model used in making orbit predictions is shown and the reentry prediction algorithm is given in detail. Orbit determination are used to identify the mean aerodynamic coefficient in function of height which represents the rate of orbit decay for the period. Results are shown as predictions of the Skylab ground tracks. Author (ESA)

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N81-20144*# National Aeronautics and Space Administration, Washington, D. C.
WITH THE SOLARIS PROJECT CNES PROPOSES TO THE EUROPEANS THE CONSTRUCTION OF AN ENTIRELY AUTOMATIC SPACE LABORATORY
J. F. Augereau Mar. 1981 5 p Transl. into ENGLISH from LeMonde (France), 21 Jan. 1981 1 p Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76492) Avail: NTIS HC A02/MF A01 CSCL 14B

Emphasis is on unmanned flight in the European program, but they are not completely eliminating the possibility of manned flights. The elements of the Solaris system are discussed. T.M.

N81-20145# Ford Aerospace and Communications Corp., Newport Beach, Calif. Aeronutronic Div.
AUTONOMOUS ACQUISITION SIMULATOR AND ASSOCIATED DATA Quarterly Technical Report, 30 Sep. - 31 Dec. 1980
S. R. King, H. Mack, A. W. Mathe, A. S. Politopoulos, J. R. Berchtold, K. R. Taylor, and J. N. Cast 15 Jan. 1981 171 p
(Contract DAAK70-80-C-0235)
(AD-A095709; QTR-1) Avail: NTIS HC A08/MF A01 CSCL 19/5

This report is the first quarterly scientific and technical report for the Autonomous Acquisition Simulator and Associated Data. Contained herein is an introduction or executive overview of the AASAD system and an architecture review of two systems studied and considered in the architectural design of AASAD. This report also defines the programming structure and its relationship with the hardware modules of the system. The Digital Video Preprocessors are described and the planned activity for the contract second quarter period is outlined. GRA

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N81-20146*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Advanced Space Programs Directorate.
SPACE PLATFORM ADVANCED TECHNOLOGY STUDY Final Report
Gene Burns Feb. 1981 75 p
(Contract NAS9-16001)
(NASA-CR-160934; MDC-G9346) Avail: NTIS HC A04/MF A01 CSCL 22B

Current and past space platform and power module studies were utilized to point the way to areas of development for mechanical devices that will be required for the ultimate implementation of a platform erected and serviced by the Shuttle/Orbiter. The study was performed in accordance with a study plan which included: a review of space platform technology; orbiter berthing system requirements; berthing latch interface requirements, design, and model fabrication; berthing umbilical interface requirements and design; adaptive end effector design and model fabrication; and adaptive end effector requirements. T.M.

N81-20147*# General Electric Co., Schenectady, N. Y.
POSITION SURVEILLANCE USING ONE ACTIVE RANGING SATELLITE AND TIME-OF-ARRIVAL OF A SIGNAL FROM AN INDEPENDENT SATELLITE Final Report, Dec. 1978 - Dec. 1979
Roy E. Anderson, Richard L. Frey, and James R. Lewis Jan. 1980 97 p refs
(Contract NAS5-25135)
(NASA-CR-166647; SRD-80-050) Avail: NTIS HC A05/MF A01 CSCL 22A

Position surveillance using one active ranging/communication satellite and the time-of-arrival of signals from an independent satellite was shown to be feasible and practical. A towboat on the Mississippi River was equipped with a tone-code ranging transponder and a receiver tuned to the timing signals of the GOES satellite. A similar transponder was located at the office of the towing company. Tone-code ranging interrogations were transmitted from the General Electric Earth Station Laboratory through ATS-6 to the towboat and to the ground truth transponder office. Their automatic responses included digital transmissions of time-of-arrival measurements derived from the GOES signals. The Earth Station Laboratory determined ranges from the satellites to the towboat and computed position fixes. The ATS-6 lines-of-position were more precise than 0.1 NMi, 1 sigma, and the GOES lines-of-position were more precise than 1.6 NMi, 1 sigma. High quality voice communications were accomplished with the transponders using a nondirectional antenna on the towboat. The simple and effective surveillance technique merits further evaluation using operational maritime satellites. Author

N81-20148# Naval Research Lab., Washington, D. C. Space Systems Div.
LORI: A MULTISATELLITE, MULTISYSTEM, TIME-COVERAGE ANALYSIS PROGRAM Final Report
William H. Harr 25 Feb. 1981 114 p
(RR0140241)
(AD-A095537; NRL-8448) Avail: NTIS HC A06/MF A01 CSCL 22/2

Locater of Repeating Incidents (LORI) is a group of programs designed for analysis of effectiveness of satellite systems in coverage of areas of the earth. Its principal features include speed of operation, ease of modification, large capabilities, and simple installation on small or large computer systems. The programs generate statistics (or specific results) on revisit times and simultaneous coverage for one or two systems of satellites, each system consisting of any number of satellites. These statistics can then be plotted as functions of time, latitude, longitude, or other variables. GRA

N81-20149# Michigan Univ., Ann Arbor.
ABOUT THE PARAMETRIC INTERPLAY BETWEEN IONIC MACH NUMBER, BODY-SIZE AND SATELLITE POTENTIAL IN DETERMINING THE ION DEPLETION IN THE WAKE OF THE S3-2 SATELLITE Final Report, 15 Jan. 1979 - 30 Sep. 1980
Uri Samir, P. J. Wildmen, F. Rich, H. C. Brinton, and R. C. Sagalyn Dec. 1980 51 p refs
(Contract F19628-79-C-0060; AF Proj. 7661)
(AD-A095507; AFGL-TR-80-0329) Avail: NTIS HC A04/MF A01 CSCL 04/1

Experimental tests of assumptions used in various wake models are practically complicated since most of the available in-situ measurements were made by flush-mounted probes, hence the measurements are confined to the very near vicinity of the bodies. The results presented in this paper are subject to the same limitation. Since the self-consistent numerical solution to the problem of body-plasma interaction (for realistic situations in space) is difficult, it seems that parametric and theory-experiment investigation, limited and imperfect as they may be, can contribute significantly to a better physical understanding of the interactions. The present investigation is aimed at presenting and discussing some experimental results which are useful to some scientific aspects of satellite-ionosphere interactions, as well as to technological/application aspects. In particular to the planning of future experiments of body-plasma electrodynamic interactions in a supersonic and subAlfvenic flow regime to be conducted on board the Shuttle/Spacelab and via the utilization of subsatellites and tethered bodies. More specifically, it is expected that investigations of the kind presented here be useful: (1) in the planning of instrument location on ejectable ensembles of probes and on the orbiter itself in future shuttle missions, (2) in predicting the disturbances expected to be created by deployed tethered-balloons and other boom-mounted bodies in future shuttle missions and (3) in testing theoretical wake models. GRA

N81-20150# Systems Science and Software, La Jolla, Calif.
PRECHARGE ENHANCED SGEMP Final Report, 27 Nov. 1978 - 1 May 1980
M. J. Mandell, G. W. Schnuelle, D. E. Parks, I. Katz, A. R. Wilson, E. M. Waisman, P. G. Steen, and M. Rotenberg 1 May 1980 119 p refs
(Contract DNA001-79-C-0079; DNA Proj. R99-QAXEE501)
(AD-A095503; SSS-R-40-4413) Avail: NTIS HC A06/MF A01 CSCL 04/1

We present analytic and numerical results relevant to the SGEMP response under conditions of strong differential charging, and a theory for dielectric surface discharges. Scaling relations are presented for space charge limited currents near edges of charged dielectrics. A new hybrid electrostatic/electromagnetic SGEMP computer code is presented. Comparisons with experiment are made for precharge enhanced SGEMP and for surface discharges. GRA

N81-20151# Naval Surface Weapons Center, Dahlgren, Va. Strategic Systems Dept.
THE INFLUENCE OF ROLL ORIENTATION-DEPENDENT AERODYNAMICS ON THE STABILITY OF CRUCIFORM

MISSILE CONFIGURATIONS Final Report
T. R. Pepitone Jan. 1981 76 p refs
(WF32395)
(AD-A095269; NSWC-TR-79-416) Avail: NTIS HC A05/MF A01 CSCL 20/4

The angular motion of a symmetric, cruciform missile, having roll orientation-dependent aerodynamics, is studied. An aerodynamic moment expansion, consistent with rotational and reflectional symmetry arguments, is incorporated into the equations of missile angular motion. A generalized version of the method of multiple scales is incorporated to generate approximate solutions to the equations of angular motion for three specific cases: free-flight angular motion at constant roll rate, induced rolling motion with a priori yawing motion, and finally the combined problem of coupled yawing and rolling motion. Critical roll rates are identified and solutions valid in the vicinity of these singular conditions are generated. Approximate solutions used to derive stability criteria are compared with numerical solutions of exact, nonlinear equations of motion. Results of the perturbation solutions show good agreement with the exact calculations for moderate angles of attack. GRA

N81-20152# Army Materiel Command, Redstone Arsenal, Ala. Engineering Directorate.
MICROELECTRONICS AVAILABILITY FOR THE ARMY'S MISSILES
Charles E. Riley 15 Sep. 1980 13 p refs
(AD-A095379; AD-E950095; DRSMI-RS-81-2-TR) Avail: NTIS HC A02/MF A01 CSCL 09/5

Our modern Army is critically dependent on high technology and in particular sophisticated electronics. Microcircuit technology is the 'brain-trust' of our advanced weapon systems. Because of the central role that microelectronics plays in the total acquisition, and maintenance of the Army's weapon systems, it is extremely important that the Army have ready access to this technology. However, the semiconductor industry is not motivated toward serving this need and therefore potential supply problems exist in this area. The Army's requirements cannot be satisfied with off-the-shelf standard products produced by the large semiconductor manufacturers. Rather, they are typically low volume, high reliability, military standard components -- some of which have the added requirement of radiation hardening. In this report the many facets and ramifications which impact the cause/effect relationships among the various factors of this very timely problem will be discussed. GRA

N81-20153# Engins Matra, Velizy (France). Div. Electronique et Automatique.
STRAPDOWN INERTIAL OPTICAL SYSTEM (SIOS) Final Report
J. C. Arnieux and B. Claudinon Paris ESA 1980 180 p
(Contract ESA-3766/78/NL-JS(SC))
(Rept-0002/DX60; ESA-CR(P)-1391) Avail: NTIS HC A09/MF A01

A feasibility study for an integrated attitude measurement system with multimission capability was performed. An SIOS for an Earth observation mission using two body fixed CCD and a set of nonorthogonal gyroscopes is analyzed. A celestial target mission is described using the same set of gyroscopes and two electrically gimballed star trackers. A communication mission from geostationary orbit and an Earth observation mission using the SPOT platform are described briefly. A computer simulation was performed for gyro drift and noise, system dynamics, and sensor noise. It is shown that a unified approach to attitude estimation, using existing space qualified components is feasible for small angle motion using linear Kalman filtering. The electrical architecture and inertial and optical sensors packages for a proposed modular SIDS are described. Author (ESA)

N81-20154# Plessey Co. Ltd., Towcester (England).
STUDY OF A REAL-TIME X-Y ADDRESSABLE SPATIAL FILTER Final Report
C. J. Kirkby and R. J. Hurditch Paris ESA Jun. 1978 201 p refs
(Contract ESTEC-2873/76/NL-AK(SC))
(CD-6500621/3; ESA-CR(P)-1397) Avail: NTIS HC A10/MF A01

Coherent processing and the requirements and limitations of spatial filters in optical processors were surveyed. The primary modes of X-Y addressing are described and their advantages and limitations are outlined. Potentially useful physical phenomena are described and the properties and performance parameters of devices based on these effects are collated. Limitations of application are identified, together with outstanding uncertainties. Electronbeam addressing in materials not of the KDP type was studied. Following a theoretical analysis of the operation of the electron beam addressed device, known electro optic materials are surveyed. Author (ESA)

N81-20155# Centre National d'Etudes Spatiales, Toulouse (France). Dept. Structures.
DAMPING SYNTHESIS FOR ARIANE PAYLOAD COUPLED ANALYSES [SYNTHESE DES AMORTISSEMENTS POUR L'ANALYSE COUPLEE ARIANE/CHARGE UTILE]
A. Girard and El. Maddah 28 Dec. 1979 24 p refs In FRENCH; ENGLISH summary Report will be announced as translation (ESA-TT-697)
(CNES-79/CT/PRT/SST/SM/331) Avail: NTIS HC A02/MF A01

The damping synthesis method used for the Ariane flight load analyses in order to take into account the damping characteristics of the launch vehicle and the payload separately is described. The composite modes are computed using a variant of the modal substitution method which is well adapted to the problem. The modal damping coefficients are introduced for each component in a diagonal or nondiagonal form, and the same transformation as for the stiffness and mass matrices is applied to the damping matrix. A nondiagonal damping matrix for the composite modes results. The potential influence of the off diagonal terms on the dynamic responses is then estimated using an efficiency criterion. This allows only the diagonal to be selected without significant loss of accuracy. The composite behavior is computed using the classical modal superposition approach. This method is validated on a sample test case, and applied to Ariane payload coupled analysis. Typical transitory response results are presented. Author (ESA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N81-20156* National Aeronautics and Space Administration, Washington, D. C.
COLUMBIA'S FIRST FLIGHT SHAKES DOWN SPACE TRANSPORTATION SYSTEM
David Garrett, Dick Young, and Terry White Apr. 1981 63 p (NASA-News-Release-81-39; P81-10039) Avail: NASA Scientific and Technical Information Facility, P. O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

The first space shuttle mission is described. Topics include launch preparations, flight profile, trajectory, and landing operations. The spaceflight tracking and data network is discussed and the photography and television schedules are included. E.D.K.

N81-20157*# Axiomatix, Los Angeles, Calif.
SHUTTLE/PAYLOAD COMMUNICATIONS AND DATA SYSTEMS INTERFACE ANALYSIS Final Report
Gaylord K. Huth 31 Dec. 1980 280 p refs
(Contract NAS9-15604)
(NASA-CR-160929; R8012-4) Avail: NTIS HC A13/MF A01 CSCL 22B

The payload/orbiter functional command signal flow and telemetry signal flow are discussed. Functional descriptions of the various orbiter communication/avionic equipment involved in processing a command to a payload either from the ground through the orbiter by the payload specialist on the orbiter are included. Functional descriptions of the various orbiter communication/avionic equipment involved in processing telemetry data by the orbiter and transmitting the processed data to the fround are presented. The results of the attached payload/orbiter

single processing and data handling system evaluation are described. The causes of the majority of attached payload/orbiter interface problems are delineated. A refined set of required flux density values for a detached payload to communicate with the orbiter is presented. For individual titles, see N81-20158 through N81-20163.

N81-20158*# Axiomatix, Los Angeles, Calif.
SHUTTLE/PAYLOAD COMMUNICATIONS AND DATA SYSTEMS INTERFACE ANALYSIS: EXECUTIVE SUMMARY Final Report
In its Shuttle/Payload Commun. and Data Systems Interface Anal. 31 Dec. 1980 5 p (For primary document see N81-20157 11-16)
(Contract NAS9-15604)
(NASA-CR-160929) Avail: NTIS HC A13/MF A01 CSCL 22B

Potential interface compatibility problems associated with interfacing OFT payload elements with orbiter communications and data handling elements that would result from payload or orbit failure to meet interface requirements contained in the orbiter/cargo standard interface specification are identified. The potential interface compatibility problems can be associated with either attached payloads in the payload bay or detached payloads communicating with the orbiter via an RF link. Evaluation of the attached payload orbiter interfaces was made by investigating interface problem areas experienced between the IUS and the orbiter since similar problems could be expected for other payloads. E.D.K.

N81-20159*# Axiomatix, Los Angeles, Calif.
SHUTTLE/PAYLOAD COMMUNICATIONS AND DATA SYSTEMS INTERFACE ANALYSIS: INTRODUCTION Final Report
In its Shuttle/Payload Commun. and Data Systems Interface Anal. 31 Dec. 1980 88 p refs (For primary document see N81-20157 11-16)
Avail: NTIS HC A13/MF A01 CSCL 22B

Potential problems associated with interfacing payload elements with orbiter communications and data handling elements are identified. Elements include Ku-band signal processor (KuSP), payload signal processor (PSP), payload interrogator (PI), payload data interleaver (PDI) and payload recorder (PR). E.D.K.

N81-20160*# Axiomatix, Los Angeles, Calif.
PAYLOAD/ORBITER SIGNAL PROCESSING AND DATA HANDLING SYSTEM EVALUATION PRESENTATION Final Report
In its Shuttle/Payload Commun. and Data Systems Interface Anal. 31 Dec. 1980 31 p (For primary document see N81-20157 11-16)
Avail: NTIS HC A13/MF A01 CSCL 22B

It is recommended that standard digital and along interfaces be adopted. These include: (1) define interfaces compatible with NASA/DOD/industry-accepted design standards; (2) investigate costs of modifying orbiter sybsystem interfaces, (3) investigate cost of designing attached payload interface unit for NASA and commercial payloads and (4) investigate costs of designing interface circuits that can be incorporated into each payload design. E.D.K.

N81-20161*# Axiomatix, Los Angeles, Calif.
PAYLOADS MINIMUM EIRP FORMULATIONS Final Report
In its Shuttle/Payload Commun. and Data Systems Interface Anal. 31 Dec. 1980 39 p (For primary document see N81-20157 11-16)
Avail: NTIS HC A13/MF A01 CSCL 22B

The effective isotropic radiated power (EIRP) of the payloads is formulated. The EIRP consists of three components; EIRP = P sub T + G sub T + L sub TX, where P sub T is the transmitter total RF output power, G sub T is the transmitting antenna gain, and L sub TX is all transmitter circuit losses. E.D.K.

N81-20162*# Axiomatix, Los Angeles, Calif.
AN UPDATE OF NONSTANDARD PAYLOAD MODULATION RESTRICTIONS Final Report
In its Shuttle/Payload Commun. and Data Systems Interface Anal. 31 Dec. 1980 3 p (For primary document see N81-20157 11-16)
Avail: NTIS HC A13/MF A01 CSCL 22B

An upgrade to restrictions as a result of a change of philosophy toward PI receiver false lock avoidance is discussed. This changed philosophy concerns sweeping the receiver VCO sufficiently fast that sideband lock is precluded, rather than relying on the lock detector to discriminate between true lock and false lock signal conditions. E.D.K.

N81-20163*# Axiomatix, Los Angeles, Calif.
PRELIMINARY INTERFACE REVISION NOTICE SD-152C UPDATE OF SECTION 8.3 OF ICD 2-19001 FOR DETACHED PAYLOADS Final Report
In its Shuttle/Payload Commun. and Data Systems Interface Anal. 31 Dec. 1980 18 p (For primary document see N81-20157 11-16)
Avail: NTIS HC A13/MF A01 CSCL 22B

The payload interrogator provides full duplex communication between the orbiter and detached payloads. This capability includes transmission of commands to and the reception of telemetry data from such payloads. Both NASA (STDN and DSN) and DOD (SGLS) transmit/receive frequency pairs are available. In addition to two way RF communication, Ku band rendezvous radar is also available. The radar skin-tracks targets in the passive mode or actively tracks transponder equipped payloads. Characteristics referring to those orbiter avionics characteristics of which the payloads must be cognizant and requirements referring to specifications placed upon payload communication equipment are discussed. E.D.K.

N81-20164*# National Aeronautics and Space Administration, Washington, D. C. Headquarters Administration Div.
SPACE SHUTTLE PROGRAM. MISSION OPERATION REPORT. ORBITAL FLIGHT TEST REFERENCE DOCUMENT
2 Mar. 1981 231 p
(NASA-TM-82321; M-989-81) Avail: NTIS HC A11/MF A01 CSCL 22B

A typical Orbital Flight Test flight profile is presented. Detailed descriptions of space shuttle flight vehicles, systems, facilities, mission support, and mission management are included. T.M.

N81-20165# Aeritalia S.p.A., Torino (Italy).
STUDY OF HEAT REJECTION SYSTEMS Final Report
L. Bussolino Paris ESA Jul. 1980 105 p refs
(Contract ESA-4024/79/NL-AK(SC))
(TC-80-TR-0054; ESA-CR(P)-1380) Avail: NTIS HC A06/MF A01

The coolants Freon 114 and Freon 11 were used in a performance test of the technology demonstration model (TDM) of a pumped fluid loop radiator for the space shuttle. These fluids may be used as alternates for the baseline Freon 21. Panel heat rejection efficiency, hydraulic performance, mass budget and materials compatibility were found to be very similar for the three fluids. Results were obtained by using the TDM design and software developed during TDM phase one. Author (ESA)

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N81-20166*# Avco Systems Div., Wilmington, Mass.
MODIFICATIONS TO THE FLEXIBLE SPACECRAFT DYNAMICS PROGRAM Final Report
15 Mar. 1980 46 p
(Contract NAS5-25678)
(NASA-CR-166655) Avail: NTIS HC A03/MF A01 CSCL 22B

Modifications to existing subroutines are briefly described and a detailed description of new subroutines is given. The capability to simulate the Dynamics Explorer-B control system new developed and the formulation for this addition is given. The program variables in new labelled COMMON blocks are described in detail and the modified input and output for the d Flexible Spacecraft Dynamics Program is described. J.M.S.

N81-20167*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE AEROSPACE VEHICLE INTERACTIVE DESIGN SYSTEM
Alan W. Wilhite Feb. 1981 25 p refs
(NASA-TM-81957) Avail: NTIS HC A02/MF A01 CSCL 22B

The aerospace vehicle interactive design (AVID) is a computer aided design that was developed for the conceptual and preliminary design of aerospace vehicles. The AVID system evolved from the application of several design approaches in an advanced concepts environment in which both mission requirements and vehicle configurations are continually changing. The basic AVID software facilitates the integration of independent analysis programs into a design system where the programs can be executed individually for analysis or executed in groups for design iterations and parametric studies. Programs integrated into an AVID system for launch vehicle design include geometry, aerodynamics, propulsion, flight performance, mass properties, and economics. Author

N81-20168*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AUTONOMOUS SPACECRAFT MAINTENANCE STUDY GROUP Final Report
Michael H. Marshall and G. David Low 1 Feb. 1981 42 p refs Sponsored in part by AF
(Contract NAS7-100)
(NASA-CR-164076; JPL-Pub-80-88) Avail: NTIS HC A03/MF A01 CSCL 22B

A plan to incorporate autonomous spacecraft maintenance (ASM) capabilities into Air Force spacecraft by 1989 is outlined. It includes the successful operation of the spacecraft without ground operator intervention for extended periods of time. Mechanisms, along with a fault tolerant data processing system (including a nonvolatile backup memory) and an autonomous navigation capability, are needed to replace the routine servicing that is presently performed by the ground system. The state of the art fault handling capabilities of various spacecraft and computers are described, and a set conceptual design requirements needed to achieve ASM is established. Implementations for near term technology development needed for an ASM proof of concept demonstration by 1985, and a research agenda addressing long range academic research for an advanced ASM system for 1990s are established. E.A.K.

N81-20169# Centre National d'Etudes Spatiales, Toulouse (France). Dept. Stabilisation-Systemes.
SYNTHESIS OF WORK CONCERNING EDDY CURRENT PENDULAR NUTATION DAMPERS. APPLICATION OF THEORY TO EQUIPMENT QUALIFICATION AND VERIFICATION ON A SPIN SIMULATOR
J. J. Runavot, J. Castro, and L. Torres 12 Jul. 1978 13 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-695)
(CNES-78/CT/PRT/SST/SS/197) Avail: NTIS HC A02/MF A01

A synthesis of the work to be done on eddy current nutation dampers for spin stabilized spacecraft is presented. The performance and the characteristic parameters of this pendular nutation damper were estimated and compared with the Mercury nutation damper developed for the METEOSAT Project. A theoretical model of the motion damping is explained. Results lead to the design of an experimental which measures intrinsic damping parameters, given the design of the elastic suspension of the damper. The test was carried out on an air bearing simulator. Attainable precision demonstrated during this test indicates that the test rig is suitable for application in the certification of various satellite spin stabilization systems. Author (ESA)

N81-20170# Centre National d'Etudes Spatiales, Toulouse (France). Div. Stabilisation Structure Thermique.
NATURAL NUTATION DAMPING DUE TO THE ERGOLS OF THE HOT GAZ PROPULSION SYSTEM. SYNTHESIS OF MV1 AND MV2 IN-FLIGHT RESULTS
J. L. Marce and duCosy 23 May 1979 9 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-698)
(CNES-79/CT/PRT/SST/SS/166) Avail: NTIS HC A02/MF A01

In-flight measurements of nutation damping onboard Symphonie satellites are interpreted and a prediction model, which determines the time constant for nutation damping as a result of momentum energy being dissipated by liquid propellants in fuel tanks is verified. Although model predictions disagree with in-flight measurements, they accurately portray the variation in damping time constant in function of tank fuel level. The radial motion of the satellite momentum wheel is evoked to explain the difference between computation and measurement.
Author (ESA)

N81-20171# Centre National d'Etudes Spatiales, Toulouse (France). Div. Stabilisation Structures Thermique.
A COMPARISON OF DAMPING SYNTHESIS METHODS FOR SPACE VEHICLE DYNAMIC ANALYSIS
El Maddah and J. F. Imbert 1 Oct. 1980 22 p refs
(CNES-80/CT/PRT/SST/SM/316) Avail: NTIS HC A02/MF A01

Substructure coupling methods for dynamic analysis are compared, emphasizing damping synthesis methods which obtain the damping characteristics of a structure from component damping test data. A variant of the modal substitution method is considered which uses component eigencharacteristics with either free or loaded interface for the main component, and fixed for branches. Also examined is the free interface method with residual flexibility. Implementation of both methods for specific cases was performed using the NASTRAN DMAP capability. Numerical comparisons of sample test cases were carried out, using a free-free beam examples, a mass-spring dashpot system, and the viscosity damped Benfield truss. This evaluation confirms the importance of the interface loading in the model substitution method and the addition of residual flexibility in free-free methods. Component damping off diagonal terms are likely to have a very significant influence on the accuracy of system modal damping. Author (ESA)

N81-20972*# National Aeronautics and Space Administration, Washington, D. C.
ROCKETS AND SPACECRAFT: SINE QUA NON OF SPACE SCIENCE
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 133-170 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 22B

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N81-20172*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIAGNOSTIC SYSTEM DESIGN FOR THE ION AUXILIARY PROPULSION SYSTEM (IAPS). FLIGHT TESTS OF TWO 8 cm MERCURY ION
E. B. Hurst and G. Z. Thomas (Hughes Aircraft Co., Los Angeles) 1981 33 p Presented at the 15th Intern. Elec. Propulsion Conf., Las Vegas, Nev., 21-23 Apr. 1981; sponsored by AIAA, Japan Society for Aeronautical and Space Sciences and DGLR (NASA-TM-81702; E-727) Avail: NTIS HC A03/MF A01 CSCL 21C

The mechanical, thermal, electrical design and the ground test results of four types of detectors are explained. The DSS is designed to measure the thruster efflux material deposition and S/C potential relative to the local plasma in the vicinity of two 8 cm mercury ion thrusters. The DSS consists of two quartz crystal microbalance (QCM) detectors, one potential probe, nine solar cell arrays, seven ion collectors and two electronic packages. T.M.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N81-20173*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF COSTS OF GALLIUM ARSENIDE AND SILICON SOLAR ARRAYS FOR SPACE POWER APPLICATIONS
Kent S. Jefferies Mar. 1981 16 p refs
(NASA-TP-1811; E-536) Avail: NTIS HC A02/MF A01 CSCL 10A

A parametric analysis was performed to compare the costs of silicon and gallium arsenide arrays for Earth orbital missions. The missions included electric power in low Earth orbit (LEO), electric power in geosynchronous Earth orbit (GEO), and power for electric propulsion of a LEO to GEO orbit transfer mission. Inputs to the analysis for all missions included launch and purchase costs of the array. For the orbit transfer mission, the launch and purchase costs of the electric propulsion system were added. Radiation flux as a function of altitude and radiation tolerance as a function of cell type were used to determine power degradation for each mission. Curves were generated that show the sensitivity of launch-array cost and total mission cost to a variety of input parameters for each mission. These parameters included mission duration, cover glass thickness, array specific cost, array specific mass, and solar cell efficiency. Solar concentration was considered and the sensitivities of cost to concentration ratio, concentrator costs, and concentrator mass were also evaluated. Results indicate that solar cell development should give a high priority to reducing array costs and that the development of low cost, lightweight, solar concentrators should be pursued. Author

N81-20174*# Hughes Research Labs., Malibu, Calif.
RETROFIT AND VERIFICATION TEST OF A 30-cm ION THRUSTER Final Report, 5 Dec. 1977 - 15 Jun. 1980
C. R. Dulgeroff and R. L. Poeschel Dec. 1980 140 p
(Contract NAS3-21052)
(NASA-CR-165233) Avail: NTIS HC A07/MF A01 CSCL 21H

Twenty modifications were found to be necessary and were approved by design review. These design modifications were incorporated in the thruster documents (drawings and procedures) to define the J series thruster. Sixteen of the design revisions were implemented in a 900 series thruster by retrofit modification. A standardized set of test procedures was formulated, and the retrofit J series thruster design was verified by test. Some difficulty was observed with the modification to the ion optics assembly, but the overall effect of the design modification satisfies the design objectives. The thruster was tested over a wide range of operating parameters to demonstrate its capabilities. T.M.

N81-20175*# Aerojet Liquid Rocket Co., Sacramento, Calif.
DUAL NOZZLE AERODYNAMIC AND COOLING ANALYSIS STUDY Final Report
G. M. Meagher 27 Feb. 1981 261 p refs
(Contract NAS8-33553)
(NASA-CR-161677; Rept-33553F) Avail: NTIS HC A12/MF A01 CSCL 21H

Analytical models to predict performance and operating characteristics of dual nozzle concepts were developed and improved. Aerodynamic models are available to define flow characteristics and bleed requirements for both the dual throat and dual expander concepts. Advanced analytical techniques were utilized to provide quantitative estimates of the bleed flow, boundary layer, and shock effects within dual nozzle engines. Thermal analyses were performed to define cooling requirements for baseline configurations, and special studies of unique dual nozzle cooling problems defined feasible means of achieving adequate cooling. T.M.

N81-20176*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME EFFECTS OF THERMAL-CYCLE-INDUCED DEFORMATION IN ROCKET THRUST CHAMBERS
Ned P. Hannum and Raymond G. Price, Jr. Apr. 1981 24 p refs
(NASA-TP-1834; E-553) Avail: NTIS HC A02/MF A01 CSCL 21H

The deformation process observed in the hot gas side wall of rocket combustion chambers was investigaged for three different liner materials. Five thrust chambers were cycled to failure by using hydrogen and oxygen as propellants at a chamber pressure of 4.14 MN/cu m. The deformation was observed nondestructively at midlife points and destructively after failure occurred. The cyclic life results are presented with an accompanying discussion about the problems of life prediction associated with the types of failures encountered in the present work. Data indicating the deformation of the thrust chamber liner as cycles are accumulated are presented for each of the test thrust chambers. From these deformation data and observation of the failure sites it is evident that modeling the failure process as classic low cycle thermal fatigue is inadequate as a life prediction method. R.C.T.

N81-20177*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIMPLIFIED POWER SUPPLIES FOR ION THRUSTERS
Robert P. Gruber 1981 24 p refs Presented at the 15th Intern. Elec. Propulsion Conf., Las Vegas, Nev., 21-23 Apr. 1981
(NASA-TM-81725; E-765) Avail: NTIS HC A02/MF A01 CSCL 21C

The initial development and demonstration of power supplies with an order of magnitude reduction in parts count, leading to increased reliability at lower weight, while still maintaining thrust system performance are discussed. Two new self-regulating keeper power supply circuits were developed and tested. One supply comprises 14 parts and uses an input voltage range of 18 to 36 volts, the other operates from 200 to 400 volts and requires 22 components. A technique for controlling heater power is also demonstrated. T.M.

N81-20178*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RECENT WORK ON AN RF ION THRUSTER
Richard Q. Lee and Shigeo Nakanishi 1981 12 p refs Presented at the 15th Intern. Elec. Propulsion Conf., Las Vegas, Nev., 21-23 Apr. 1981; sponsored by AIAA, Japan Society for

Aeronautical and Space Sciences and DGLR
(NASA-TM-81734; E-802) Avail: NTIS HC A02/MF A01 CSCL 21C

An experimental investigation of an rf ion thruster using an immersed coupler in an argon discharge is reported. The conical coil, used to couple rf power into the discharge, is placed inside the discharge vessel. The discharge was self-sustained by 100-150 MHz rf power at low environmental pressures. The ion extraction was accomplished by conventional accelerated grid optics from an unoptimized 8 cm diameter ion thruster. T.M.

N81-20179*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXTENDED OPERATING RANGE OF THE 30-cm ION THRUSTER WITH SIMPLIFIED POWER PROCESSOR REQUIREMENTS
V. K. Rawlin 1981 15 p refs Presented at the 15th 1981; cosponsored by the AIAA, Japan Soc. for Aeron. and Space Sci. and DGLR
and Space Sci. and Deut. Ges. fur Luft- und Raumfahrt
(NASA-TM-81729; E-772) Avail: NTIS HC A02/MF A01 CSCL 21C

A two grid 30 cm diameter mercury ion thruster was operated with only six power supplies over the baseline J series thruster power throttle range with negligible impact on thruster performance. An analysis of the functional model power processor showed that the component mass and parts count could be reduced considerably and the electrical efficiency increased slightly by only replacing power supplies with relays. The input power, output thrust, and specific impulse of the thruster were then extended, still using six supplies, from 2660 watts, 0.13 newtons, and 2980 seconds to 9130 watts, 0.37 newtons, and 3820 seconds, respectively. Increases in thrust and power density enable reductions in the number of thrusters and power processors required for most missions. Preliminary assessments of the impact of thruster operation at increased thrust and power density on the discharge characteristics, performance, and lifetime of the thruster were also made. E.D.K.

N81-20180*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FREE RADICAL PROPULSION CONCEPT
C. E. Hawkins and S. Nakanishi 1981 25 p refs Presented at 15th Intern. Elec. Propulsion Conf., Las Vegas, Nevada, 21-23 Apr. 1981; sponsored by AIAA, Japan Society for Aeronautical and Space Sciences and DGLR
(NASA-TM-81770; E-813) Avail: NTIS HC A02/MF A01 CSCL 21C

A free radical propulsion concept utilizing the recombination energy of dissociated low molecular weight gases to produce thrust was examined. The concept offered promise of a propulsion system operating at a theoretical impulse, with hydrogen, as high as 2200 seconds at high thrust to power ratio, thus filling the gas existing between chemical and electrostatic propulsion capabilities. Microwave energy used to dissociate a continuously flowing gas was transferred to the propellant via three body recombination for conversion to propellant kinetic energy. Power absorption by the microwave plasma discharge was in excess of 90 percent over a broad range of pressures. Gas temperatures inferred from gas dynamic equations showed much higher temperatures from microwave heating than from electrothermal heating. Spectroscopic analysis appeared to corroborate the inferred temperatures of one of the gases tested. R.C.T.

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N81-20181# Los Alamos Scientific Lab., N. Mex. Design Engineering Div.
FUNDAMENTAL UNDERSTANDING OF MATTER: AN ENGINEERING VIEWPOINT
Hatice S. Cullingford and G. Edward Cort 1980 12 p refs Presented at the 3rd Miami Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 15-18 Dec. 1980
(Contract W-7405-eng-36)
(LA-UR-80-3585; CONF-801210-16) Avail: NTIS HC A02/MF A01

Fundamental understanding of matter is a continuous process that should produce physical data for use by engineers and scientists in their work. Lack of fundamental property data in any engineering endeavor cannot be mitigated by theoretical work that is not confirmed by physical experiments. An engineering viewpoint is presented to justify the need for understanding of matter. Examples are given in the energy engineering field to outline the importance of further understanding of material and fluid properties and behavior. Cases are cited to show the effects of various data bases in energy, mass, and momentum transfer. The status of fundamental data sources is discussed in terms of data centers, new areas of engineering, and the progress in measurement techniques. Conclusions and recommendations are outlined to improve the current situation faced by engineers in carrying out their work. DOE

N81-20182# Oklahoma State Univ., Stillwater. Dept. of Chemistry.
POLYNUCLEAR AROMATIC COMPOUNDS. SYNTHESIS AND PURIFICATION Final Report
E. J. Eisenbraun Dec. 1980 100 p refs
(Grant EPA-R-805419)
(PB81-125015; EPA-600/2-80-204) Avail: NTIS HC A05/MF A01 CSCL 07C

The synthesis and/or purification of a group of polynuclear aromatic (PNA) compounds commonly found as pollutants in the environment are reviewed and discussed. The experimental procedures and techniques as well as chromatographic and spectroscopic evidence of structure and purity of the compounds supplied to the U.S. Environmental Protection Agency are described. In addition, the apparatus designed and constructed to meet the synthesis needs together with safety improvements for handling toxic compounds are described. Publications resulting the study and manuscripts in preparation are cited. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N81-20183 Florida Univ., Gainesville.
EXPERIMENTAL STUDIES OF THE DELAMINATION MECHANISMS IN IMPACTED FIBER-REINFORCED COMPOSITE PLATES Ph.D. Thesis
Nobuo Takeda 1980 200 p
Avail: Univ. Microfilms Order No. 8105621

The fracture mechanisms in centrally impacted fiber-reinforced composite laminated plates were investigated. Semitransparent specimens were fabricated from fiberglass/epoxy prepreg tapes with an autoclave. A cross-ply arrangement with 3 laminas each containing 5 unidirectional layers was studied unless otherwise states. Macroscopic observations of impacted laminates, which revealed the impactor/laminate configuration interactions, were supplemented by microscopic observations of cross sections of impacted laminates with a scanning electron microscope. Dynamic strains induced by impact of 2.54 cm blunt ended impactors on laminates were measured using both surface and embedded gages with several different gage layouts. High speed camera recorded rapid delamination crack propagations at speeds up to 40,000 frames/sec. Dissert. Abstr.

N81-20184*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
CALCULATION OF THE ROOM-TEMPERATURE SHAPES OF UNSYMMETRIC LAMINATES Progress Report, 1 Sep. - 31 Dec. 1980
Michael W. Hyer Mar. 1981 35 p refs
(Contract NCC1-15)
(NASA-CR-163993; IR-24; VPI-E-81-4) Avail: NTIS HC A03/MF A01 CSCL 11D

A theory explaining the characteristics of the cured shapes of unsymmetric laminates is presented. The theory is based on an extension of classical lamination theory which accounts for

geometric nonlinearities. A Rayleigh-Ritz approach to minimizing the total potential energy is used to obtain quantitative information regarding the room temperature shapes of square T300/5208 (0(2)/90(2))T and (0(4)/90(4))T graphite-epoxy laminates. It is shown that, depending on the thickness of the laminate and the length of the side the square, the saddle shape configuration is actually unstable. For values of length and thickness that render the saddle shape unstable, it is shown that two stable cylindrical shapes exist. The predictions of the theory are compared with existing experimental data. E.D.K.

N81-20185*# Drexel Univ., Philadelphia, Pa.
DEFORMATION CHARACTERISTICS AND FAILURE MODES OF NOTCHED GRAPHITE POLYIMIDE COMPOSITES AT ROOM AND ELEVATED TEMPERATURES Progress Report, 1 Jun. 1979 - 31 Aug. 1980
Jonathan Awerbuch, Harry E. Perkinson, and Ihab L. Kamel Aug. 1980 125 p refs
(Grant NsG-1606)
(NASA-CR-159375) Avail: NTIS HC A06/MF A01 CSCL 11D

The fracture behavior in graphite/polyimide (Gr/PI) Celion 6000/PMR-15 composites was characterized. Emphasis was placed on the correlation between the observed failure modes and the deformation characteristics of center-notched Gr/PI laminates. Crack tip damage growth, fracture strength and notch sensitivity, and the associated characterization methods were also examined. Special attention was given to nondestructive evaluation of internal damage and damage growth, techniques such as acoustic emission, X-ray radiography, and ultrasonic C-scan. Microstructural studies using scanning electron microscopy, photomicrography, and the pulsed nuclear magnetic resonance technique were employed as well. All experimental procedures and techniques are described and a summary of representative results for Gr/PI laminates is given. J.M.S.

N81-20186*# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.
DETERMINATION OF LOAD SEQUENCE EFFECTS ON THE DEGRADATION AND FAILURE OF COMPOSITE MATERIALS Final Technical Report
Jann N. Yang and Douglas L. Jones 1981 15 p refs
(Grant NsG-1604)
(NASA-CR-164065) Avail: NTIS HC A02/MF A01 CSCL 11D

A theoretical model was established to predict the fatigue behavior of composite materials, with emphasis placed on predictions of the degradation of residual strength and residual stiffness during fatigue cycling. The model parameters were evaluated from three test series including static strength fatigue life and residual strength tests. The tests were applied to two graphite/epoxy laminates. Load sequence effects were emphasized for both laminates and the predicted results agreed quite well with subsequent verification tests. Dynamic as well as static stiffness reduction data were collected by use of a PDP11-03 computer, which performed quite satisfactorily and permitted the recording of a substantial amount of dynamic stiffness reduction data. A.R.H.

N81-20187*# National Aeronautics and Space Administration, Washington, D. C.
ACOUSTIC EMISSION MONITORING OF POLYMER COMPOSITE MATERIALS
Reinhard Bardenheier Feb. 1981 29 p refs Transl. into ENGLISH from Z. fuer Werkstofftech. (West Germany), v. 11, Mar. 1980 p 101-110 Original language document announced as A80-30581 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76523) Avail: NTIS HC A03/MF A01 CSCL 11D

The techniques of acoustic emission monitoring of polymer composite materials is described. It is highly sensitive, quasi-nondestructive testing method that indicates the origin and behavior of flaws in such materials when submitted to different load exposures. With the use of sophisticated signal analysis methods it is possible the distinguish between different types of failure mechanisms, such as fiber fracture delamination or fiber pull-out. Imperfections can be detected while monitoring complex composite structures by acoustic emission measurements.Author

N81-20188*# National Aeronautics and Space Administration, Washington, D. C.
EVALUATION OF THE BEHAVIOR OF STRUCTURES MADE OF HIGH MODULUS COMPOSITE MATERIALS WHEN STRUCK BY LIGHTNING
J. Rouchon and D. Gall Jan. 1981 28 p refs Transl. into ENGLISH of "Evaluation du Comportement a la Foudre de Structures en Materiaux Composites Haut Module" AGARD, (Paris), 14 p Presented at 50th Reunion of the Struct. and Mater. Panel, Specialists Meeting on Effect of Service Environ. on Composite Mater., Athens, 13-18 Apr. 1980 Translation was announced as N81-11141 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Aeronautique de Toulouse, France
(Contract NASw-3198)
(NASA-TM-75866) Avail: NTIS HC A03/MF A01 CSCL 11D

Lightning strikes on aircraft are a relatively frequent phenomena which result in damage to the equipment as well as to structures, especially parts made of composite materials. General information about lightning (measurements of the characteristics of lightning during flight, simulation procedures on the ground) is followed by results of the tests carried out at the laboratory on samples (monolithic carbon epoxy samples, sandwich samples covered with boron epoxy covering) and tests with real structures. The associated control procedures are described. A.R.H.

N81-20189*# Office of Science and Technology, Washington, D. C.
CARBON/GRAPHITE COMPOSITE MATERIAL STUDY Annual Report, 1980
Jan. 1981 122 p refs Sponsored in part by NASA, Office of Science and Technology Policy, DOT, DOE, Dept. of Commerce, EPA, Dept. of Health and Human Services, Dept. of Labor, Federal Emergency Management Agency, Dept. of State, DOD and Office of Management and Budget
(NASA-CR-164084; AR-3) Avail: NTIS HC A06/MF A01 CSCL 11D

The potential problems arising from the projected increased use of carbon fiber composite materials in civilian applications are addressed. The primary concern was the electrical hazard associated with carbon fibers released from burning of carbon fiber composites and disposal of carbon composite waste or worn out parts. Final reports of the NASA, DOT, DOE, DOD, and DOC and progress reports of the EPA, DHHS (NIOSH), DOL (OSHA), and the FEMA are presented. Also included are the findings of the Office of Science and Technology Policy, the status of agency responsibilities, and a list of applicable references. L.F.M.

N81-20190# IIT Research Inst., Chicago, Ill.
PHOTOELASTIC STUDIES OF INTERNAL STRESS DISTRIBUTIONS OF UNIDIRECTIONAL COMPOSITES Final Report, 11 Sep. 1979 - 11 Sep. 1980
I. M. Daniel, G. M. Koller, and T. Niiro Watertown, Mass. Army Materials and Mechanics Research Center Dec. 1980 55 p refs
(Contract DAAG46-79 C-0083; DA Proj. 1L1-61102-AH-42) (AD-A095595; IITR-M6062; AMMRC-TR-80-56) Avail: NTIS HC A04/MF A01 CSCL 11/4

Two dimensional photoelastic models were used to determine internal loading and residual stress distributions on the transverse cross section of unidirectional composites. The variation of residual stress was determined as a function of post-curing temperature for a room temperature cured matrix resin. Maximum stresses and strains were determined in the matrix of a unidirectional composite with a 0.50 fiber volume ratio. Prototype composite specimens were made with the same matrix material and the same fiber volume ratio and were cured under the same conditions as the models. The transverse strength of these prototype specimens was predicted satisfactorily from results of model tests for the room temperature cured specimens. In the case of the post-cured specimens, the predictions were higher than the measured strength. GRA

N81-20191# General Atomic Co., San Diego, Calif.
FRICTION AND WEAR STUDIES OF GRAPHITE AND A CARBON-CARBON COMPOSITE IN AIR AND HELIUM
C. C. Li and J. E. Sheehan Oct. 1980 12 p refs Presented at the Intern. Conf. on Wear of Materials, San Francisco, 31 Mar. - 1 Apr. 1981
(Contract DE-AT03-76ET-35300; GA Proj. 6400)
(GA-A-16054; CONF-810301-2) Avail: NTIS HC A02/MF A01

Sliding friction and wear tests were conducted on a commercial isotropic graphite and a carbon carbon composite in air, purified helium, and a helium environment containing controlled amounts of impurities simulating the primary coolant chemistry of a high temperature gas cooled reactor (HTGR). The friction and wear characteristics of the materials investigated were stable and were found to ber very sensitive to the testing temperature. In general, friction and wear decreased with increasing temperature in the range from ambient to 950 C. Graphite and carbon carbon composites are favorable candidate materials for high temperature sliding service in helium cooled reactors. DOE

N81-20192# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
FLEXURE TESTS OF THREE FIBROUS COMPOSITE MATERIALS
Lennart Knutsson and H. Bjermert Oct. 1980 21 p refs
(Contract STU-78-5542)
(FFA-TN-HU-2127-Pt-3) Avail: NTIS HC A02/MF A01

Carbon and glass/ester composites were tested for flexural stiffness and strength. The test specimens were prepared from three types of composite materials: carbon fiber cloth/vinylester, glassfiber cloth/vinylester, and glassfiber/polyester in prepreg form. Laminates of each of these materials were manufactured by hand lay-up, vacuum molding and pressure molding, except for the prepreg material which was only processed by the two latter method. Results show that the flexural modulus is improved for all types of material if the pressure molding method is used when curing the laminates. The interlaminar shear strength tests of the bonded specimens indicate that the epoxy bonding gives better interlaminate strength properties than the vinyl bonding, when the vacuum bag technique is used. It is the other way around for the pressure molded laminate. Pressure molding gives the best properties with respect to both modulus and strength for the prepreg material. The other two materials have better strength properties when cured by the vacuum bag technique than by pressure molding. The hand lay-up laminates have properties that were in between the other two curing methods. Author (ESA)

N81-20193# Bristol Univ. (England). Dept. of Aeronautical Engineering.
SCARF JOINTS IN UNIDIRECTIONAL CARBON FIBER REINFORCED PLASTICS B.S. Thesis
N. A. D. Murphy and M. G. Thorton Jun. 1980 56 p refs Sponsored by British Gliding Assoc.
(BU-258) Avail: NTIS HC A04/MF A01

A method for repairing unidirectional carbon fiber reinforced plastic (CFRP) spar booms was investigated. An application of CFRP tests was carried out on the basic material to determine its mechanical properties and on tensile specimens repaired using the proposed scarf joint method. Theoretical models were developed to support these tests. The scarf tip is found to be the critical area, with the highest stresses and greatest sensitivty to material quality and finish. Some form of additional binding of the tip fibers appears to be necessary. Results suggest that repaired strengths of up to 60% of the original strength can be obtained, with a wet-dry repair, subject to quality of material and repair, using slopes in excess of 1 in 50. Author (ESA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N81-20194 Duke Univ., Durham, N. C.
MATHEMATICAL MODELS FOR DISPERSION OF CHROMATOGRAPHIC SOLUTE BANDS Ph.D. Thesis
Michael Bryan Sumner 1980 209 p
Avail: Univ. Microfilms Order No. 8105685

Studies of extra-column band dispersion effects in chromatography were made, and two theoretical models based on Poiseuille flow and ideal mixing (exponential modification) were examined. The experimental work involved the use of gas and liquid chromatography (with emphasis on the latter), dye injection studies, statistical moment analysis, and computer simulation modeling. The primary research strategy was the comparison of chromatographic results, after insertion of extra connecting tubing into the instrument, with the results of simulations based on computer algorithms which performed numerical operations on digitized peaks obtained before insertion of the additional tubing. Non-ideal effects due to diffusion were considered in the interpretations of the results. Dispersion in extra-column dead volumes, under ordinary chromatographic conditions, is characterized by ideal Poiseuille-flow dispersion, modified by mixing, diffusion, or other non-ideal effects which tend to redistribute solute over the cross-section of the connecting tubing. Dissert. Abstr.

N81-20195 Duke Univ., Durham, N. C.
A CHROMATOGRAPHIC AND SPECTROSCOPIC CHARACTERIZATION OF CHEMICALLY BONDED STATIONARY PHASES Ph.D. Thesis
Darrel Ray Wilder 1980 218 p
Avail: Univ. Microfilms Order No. 8105688

An examination of chemically modified silica surfaces was accomplished using chromatographic and spectroscopic methods. Information about the sorptive behavior of modified microparticulate silica gels that typify bonded stationary phases employed in liquid chromatographic applications was obtained. Surface-immobilized alkyl, cycloalkyl, aminoalkyl, and heteroaromatic systems were prepared to provide examples of nonpolar bonded phases in current use. A chromatographic investigation of non-polar bonded phases in current use. A chromatographic investigation of non-polar phases was undertaken. A comparison of a chromatographic system using n-alkyl bonded phases and a liquid-liquid partioning system employing analogous n-alkane organic phases was made. The comparison suggested the potential for liquid-like partioning of small hydrophobic solutes into the longer chain n-alkyl bonded phases. Dissert. Abstr.

N81-20196 Duke Univ., Durham, N. C.
THE APPLICATION OF PHOTOACOUSTIC SPECTROSCOPY TO ELECTRONIC SPECTROSCOPY OF CRYSTALLINE SOLIDS Ph.D. Thesis
Joseph Charles Roark 1980 316 p
Avail: Univ. Microfilms Order No. 8105681

The use of photoacoustic spectroscopy (PAS) to obtain the electronic absorption spectra of crystalline solids was investigated. Particular emphasis was placed on the possibilities of obtaining linearly polarized absorption spectra and circular dichroism spectra using photoacoustic (PA) detection. Using existing PA theories work toward developing methods that enable quantitative absorption spectra to be obtained using PA techniques alone. This led to the development of methods which use the phase angle of the PA signal rather than its magnitude for this purpose. Analytical solutions using both the thermal piston and composite piston models are derived. Dissert. Abstr.

N81-20197 Florida Univ., Gainesville.
INFRARED INTENSITIES OF ALCOHOLS AND ETHERS Ph.D. Thesis
Jerry Dale Rogers 1980 298 p

Avail: Univ. Microfilms Order No. 8105604

Infrared intensities of gas phase methanol were remeasured experimentally using the technique of Wilson and Wells as modified by Penner and Weber. The values measured are in reasonable agreement with literature values, and best estimates are made for the absolute intensities of the vibrational modes of methanol. These intensities are used together with an ab initio quantum mechanical calculation of the signs of the dipole moment derivatives to derive atomic polar tensors for methanol. The effects both of the normal coordinates and of other sign choices on the atomic polar tensors for methanol are discussed. These polar tensors are used to predict the infrared intensities for ethers and higher alcohols. Dissert. Abstr.

N81-20198 Iowa State Univ. of Science and Technology, Ames.
THE INFLUENCE OF TURBULENCE ON COMBUSTION IN OPEN PRE-MIXED FLAMES Ph.D. Thesis
Eldon Stanley Powell 1980 170 p
Avail: Univ. Microfilms Order No. 8106044

A crossed beam Schlieren system was used to study the structure of an open, premixed, turbulent, stoichiometric propane air flame. The crossed beam Schlieren system consisted of two identical laser and light sensitive detector assemblies arranged so the laser beams intersected in the flame region. Cross correlation of the detector outputs was used to extract local information about the flame structure in the vicinity of the intersection of the beams. A physical model for the flame structure was inferred from the local information. The model was a disperse flame model with burning kernels surrounded by unburned gas. The model was experimentally verified. The kernels were mathematically modeled as expanding spheres and the signals predicted by the assumption of spherical kernels were used to analyze the flame generated signals to give an estimates of the equivalent kernel number density distribution as a function of diameter on the flame centerline. The variation of the kernel distribution through the flame was consistent with physical model. Dissert. Abstr.

N81-20199 Michigan Univ., Ann Arbor.
GAS CHROMATOGRAPHY OF POLYBROMINATED BIPHENYLS UTILIZING ELECTRON CAPTURE DETECTION Ph.D. Thesis
Janet Arey Sweetman 1980 225 p
Avail: Univ. Microfilms Order No. 8106232

Polybrominated biphenyls (PBBs) are industrial compounds manufactured as fire retardants. In 1973 these toxic chemicals were accidentally introduced into the human food chain in Michigan. The quantitation of PBBs in environmental samples requires the quantitation of several isomers (potentially 209). To utilize the sensitivity of the electron capture detector for brominated compounds, it is necessary to have the individual PBB isomers to calibrate the detector or to be able to predict the response to each isomer. This work examines the sensitivity-structure relationship of the electron capture detector for PBB's. The sensitivity of the detector was found to increase approximately linearly with the number of bromines on the biphenyl nucleus. Dissert. Abstr.

N81-20200 California Univ., Davis.
THE PHOTOCHEMICAL TRANSFORMATIONS OF ORGANIC COMPOUNDS IN SEAWATER Ph.D. Thesis
Michael James Miille 1980 84 p
Avail: Univ. Microfilms Order No. 8105398

The photolysis of pentachlorophenol (PCP) differed in both rate and product distribution between distilled water and seawater systems. Photolysis rates were slower in seawater due to the photonucleophilic interaction of PCP with chloride ions demonstrated by the formation of 36Cl labeled PCP in irradiated solutions containing Na36ClDCA(3,4 Dichloroaniline) showed no rate change between the different media, and gave identical products in both systems. PCP and DCA yielded greater muconic acid was isolated and identified as a new PCP photoproduct which is the immediate result of ring fission. The details of photooxidation, photonucleophilic substitution, and photoreduction reactions are different between seawater and distilled water, and that sunlight can have a significant effect on organic pollutants in the marine environment. Dissert. Abstr.

N81-20201 Florida State Univ., Tallahassee.
ASPECTS OF METAL NMR AND HIGH SENSITIVITY PROBE DESIGN Ph.D. Thesis
John Terry Bailey 1980 129 p
Avail: Univ. Microfilms Order No. 8106261

The usefulness of metal nuclear magnetic resonance is demonstrated in several applications. The specific nuclei considered here are cobalt 59, yttrium 89, and molybdenum 95. In addition, the design of probes to allow observation of these metal nuclei is described. Traditional measurement methods give maximum sensitivities of + 1 degree under the best conditions. Besides the low accuracy, these methods act as point detectors and are not sensitive to any temperature gradients which may occur in the sample. The temperature dependence of the 59Co chemical shift has been determined for two systems, K3Co(CN)6 in D2O and Co(acac)3 in CDC3, both 0.1M. Dissert. Abstr.

N81-20202 Pennsylvania State Univ., University Park.
CLASSIFICATION OF PETROLEUM SAMPLES FROM GAS CHROMATOGRAPHIC DATA BY PATTERN RECOGNITION TECHNIQUES AND SIMULATION OF MASS SPECTRA BY REGRESSION ANALYSIS OF STRUCTURAL DESCRIPTORS Ph.D. Thesis
Hayden Adams Clark 1980 148 p
Avail: Univ. Microfilms Order No. 8105709

A study of the classification of petroleum samples using pattern recognition analysis of gas chromatographic data was performed. A set of 42 gas chromatograms of petroleum samples was voded using 19 descriptors peak heights above unresolved background of the normal alkanes from nC14 through nC25, peak heights of the branched alkanes pristane and phytane, and five ratios of these 14 raw descriptors. A linear learning machine, a heuristic method of finding a discriminant function, was trained to recognize samples and predict unknowns. Predictive abilities of 87 to 100 percent were obtained. K nearest neighbor classifications were made for comparison. Further study, using data from both weathered and unweathered samples confirmed that samples could be recognized correctly when the samples were of like origin and weathering history. Four types of oil were represented by gas chromatograms taken before and after artificial weathering. Dissert. Abstr.

N81-20203 Virginia Univ., Charlottesville.
METAL-METASTABLE ENERGY TRANSFER FOR ATOMIC LUMINESCENCE Ph.D. Thesis
William Baldwin Dodge, III 1980 145 p
Avail: Univ. Microfilms Order No. 8017947

A multielement atomic emission source based upon the energy transfer from metastable nitrogen molecules to metal atoms was developed. A dielectric discharge through flowing nitrogen generates a large population of metastable molecules which are then mixed with thermally vaporized metallic species in a reaction cell. The resulting chemiluminescent reaction produces a low background emission spectrum where the emission intensity is proportional to the metal atom concentration. The large excess and long life of the metastable nitrogen permits multiple excitation emission cycles to occur during the resident time of the analtye in the reaction chamber. This low cost emission source exhibits excellent sensitivity, with typical detection limits in a prototype of less than 1 million atoms cu cm, for a number of metals including Cd, Hg, Sn, and Zn. Wide ranging applications for this ultra trace metal analyzer exist in environmental monitoring, clinical chemistry and forensic science. Dissert. Abstr.

N81-20204 Utah Univ., Salt Lake City.
THERMAL LENS CALORIMETRY Ph.D. Thesis
Norman John Dovichi 1980 110 p
Avail: Univ. Microfilms Order No. 8105322

The development of thermal lens calorimetry as an instrument for chemical analysis is considered. The technique is introduced with sufficient theory for the remainder of the work. The application of the effect for trace level copper determination is presented. A differential thermal lens calorimeter is described wherein background signal is automatically subtracted. The improvements in detection limit and linearity provided by a regression analysis of the time resolved thermal lens data. Thermal lens calorimetry is extended to a flowing sample for potential application in liquid chromatography and flow injection analysis. Instrumental

considerations is discussed for the double beam experiment along with analytical results for the determination of iron(II).
Dissert. Abstr.

N81-20205 Cornell Univ., Ithaca, N. Y.
QUANTITATIVE ION MICROSCOPY BY DIGITAL IMAGE PROCESSING Ph.D. Thesis
David Manfred Drummer 1980 81 p
Avail: Univ. Microfilms Order No. 8102915

The subject of ion image quantification via digital image processing method is discussed with special attention paid to problems encountered by previous researchers. A brief description of the ion microscope, the production of ion images, and a background of digital image processing both for images in general and more specifically for ion images are presented. The concept of a sampling constant for the evaluation of sample heterogeneity is described and applied to a low alloy steel matrix. Also demonstrated is a procedure to relate the sampling constants for a given matrix to the sampling error to be expected from a particular analysis, or conversely, to the number of replicate analyses required to achieve a desired precision. Dissert. Abstr.

N81-20206 Columbia Univ., New York.
LASER FLUORESCENCE IMMUNOASSAY Ph.D. Thesis
Steven David Lidofsky 1980 110 p
Avail: Univ. Microfilms Order No. 8104949

Three methods for immunoassay are described in which a laser serves as an excitation source. Limits of detection are comparable to those of radioimmunoassary. In each, insulin is employed as a model compound for measurement.
Dissert. Abstr.

N81-20207 Iowa State Univ. of Science and Technology, Ames.
LASER FLUORESCENCE DETECTION FOR HIGH PERFORMANCE LIQUID CHROMATOGRAPHY Ph.D. Thesis
Michael Joseph Sepaniak 1980 151 p
Avail: Univ. Microfilms Order No. 8106053

The excellent sensitivity and selectivity of HPLC with laser fluorescence detection is demonstrated with examples in the biological and environmental fields. The spectral advantages of laser excitation for fluorescence HPLC detection, most notably the high output power of the laser is discussed and illustrated for the low picogram level determination of the antitumor drugs adriamycin and daunorubicin in body fluids, and for the characterization of coal-derived asphaltenes. Dissert. Abstr.

N81-20208 Virginia Univ., Charlottesville.
STUDIES IN CHEMICAL IONIZATION MASS SPECTROMETRY Ph.D. Thesis
Satinder Kumar Sethi 1980 149 p
Avail: Univ. Microfilms Order No. 8026647

Positive ion and negative gas phase ion/molecule isotope exchange reactions are described which facilitate the use of mass spectrometry for counting the number of hydrogens in several specific structural environments within an organic sample. The utility of these ion/molecule reactions in determining the site of proton transfer and as a probe for ion structure is also described. A possible mechanism for exchange process is discussed. In addition, gas phase ion/molecule reactions of hydroxyl anion are described and the utility of hydrazoic acid an methyl azide as CI reagents is discussed. The collision induced dissociation mass spectrometry is employed to probe ion structure in these studies. Dissert. Abstr.

N81-20209 North Carolina Univ. at Chapel Hill.
APPLICATIONS OF MICROCOMPUTERS TO SPECTROSCOPY AND ELECTROCHEMISTRY Ph.D. Thesis
Judy Hinderliter Smith 1980 475 p
Avail: Univ. Microfilms Order No. 8104838

The UNC-Chem Microcomputer, designed as a laboratory computer for high speed data acquisition, is discussed. Experiments with data rates up to 71 KHz (1 output and 2 input channels) were controlled by the microcomputer. Three data acquisition systems and a spectral search system are described. A multichannel analyzer controlling a 650B ESCA spectrometer was replaced by a UNC-Chem Microcomputer. Instrument throughput was significantly increased and data quality was enhanced. A Boolean search algorithm was implemented for a library of 2229 carbon (13) NMR spectra. The library was searched and a list of matches and near matches displayed in 6 seconds. Software was also developed to control two electrochemistry experiments, cyclic staircase voltammetry, and Fourier transform electrochemistry. The theory for each technique is reviewed. The software (including user documentation) and experimental results are described. Dissert. Abstr.

N81-20210 Iowa State Univ. of Science and Technology, Ames.
NEW TECHNIQUES IN ATOMIC AND MOLECULAR LASER SPECTROSCOPY Ph.D. Thesis
Larry Eugene Steenhoek 1980 169 p
Avail: Univ. Microfilms Order No. 8106060

Techniques in atomic and molecular laser spectroscopy are presented. Doppler free intracavity two photon absorption in gas phase naphthalene was demonstrated. A CW tunable dye laser system was modified to incorporate an intracavity gas cell. This technique has advantages over the conventional pulsed type setup. The observed linewidths of the Doppler free two photon rovibronic features of the naphthalene excitation spectrum are on the order of 300 MHz. The combined effects of laser width, frequency scanning rate and high density of states make it impossible to resolve individual rovibronic lines. A giant pulse ruby laser and a CW tunable dye laser were combined to form a unique inverse Raman Spectrometer for the determination of absolute Raman cross sections. Dissert. Abstr.

N81-20211 Cornell Univ., Ithaca, N. Y.
ELEMENTAL DISTRIBUTIONS OF BIOLOGICAL MATERIALS BY ION MICROSCOPY Ph.D. Thesis
Katherine Mary Stika-Bisaha 1980 121 p
Avail: Univ. Microfilms Order No. 8102907

The development and application of sample preparation and ion microscopic analysis procedures for biological material that preserve the original elemental distributions and concentrations in the specimen is discussed. A set of critical was generated for successful sample preparation which, when satisfied, result in ion images of well resolved spatial detail and ion distributions which may be corroborated by other elemental localization techniques. A number of collaborative efforts with biological scientists of diversified interests were undertaken to test the applicability of the proposed analytical methods. These include: (1) the determination of ion distributions in the goblet cells in the human colon; (2) localization of calcium in an extraosseous osteogenic sarcoma; (3) the cadmium localization in the intestines of chickens to determine toxicity effects; (4) the determination of ion distributions associated with leaf movements in the Mimosa plant; and (5) the analysis of lithium uptake in the brains of test animals treated for manic depression. Dissert. Abstr.

N81-20212 California Univ., Davis.
DETECTION OF METAL IONS BY GLASS CAPILLARY GAS CHROMATOGRAPHIC SEPARATION OF THEIR VOLATILE CHELATES Ph.D. Thesis
Leopoldo Sucre 1980 232 p
Avail: Univ. Microfilms Order No. 8105414

The utility of several wall coated open tubular glass capillary columns to separate the trifluoroacetylacetonates of Be(II), Al(III), Cr(III) and Cu(II), the diethyldithiocarbamates of Se(II), Zn(II), Cd(II), Cu(II), Pb(II), Ni(II) and Co(III), the di(trifluoroethyl) dithiocarbamates of Ni(II) and Co(III), and the diisopropyldithiophosphates of Zn(II), Ni(II) and Pd(II) was investigated. The increased sensitivity and selectivity offered by electron captured detector, nitrogen-phosphorus detector and flame photometric detector, in its sulfur and phosphorus mode, were also explored in the detection of the above chelates. Most favorable results were obtained with a short highly inert fused silica column, coated with a nonretentive liquid phase. The possibility of separating some alkylxanthates of Ni(II) by glass capillary gas chromatography was also studied. The trifluoroethyl and pentafluoropropylxanthate of Ni(II) and Pd(II) were prepared, purified and characterized by IR, MS, and TGA. They showed limited volatility and thermal stability and search for optimum gas chromatographic parameters for their elution proved so far fruitless. Dissert. Abstr.

N81-20213 Georgia Inst. of Tech., Atlanta.
A THEORETICAL INVESTIGATION OF THE PYROLYSIS OF

SOLID FUELS INCLUDING CONDENSATION EFFECTS Ph.D. Thesis
Kazhikathra Kailasanath 1980 164 p
Avail: Univ. Microfilms Order No. 8105827

The effects of nucleation rate and the rate of generation of condensable vapor on the particulate concentration within the porous fuel were investigated. For all the investigated cases, the lifetime of the generated particles was less than a fraction of a minute. When the incident radiant heat flux was increased, the particles vaporized completely in a shorter time. These results lead to the conclusion that heterogeneous condensation within the decomposing solid is not an important mechanism of smoke formation in the pyrolysis of solid fuels under nonflaming conditions. Dissert. Abstr.

N81-20214 Pennsylvania State Univ., University Park.
A STUDY OF FLAME SPREADING AND COMBUSTION PROCESSES IN SOLID PROPELLANT CRACKS Ph.D. Thesis
Mridul Kumar 1980 215 p
Avail: Univ. Microfilms Order No. 8105751

The development of convective burning in solid propellant cracks was studied using both theoretical and experimental methods. In the theoretical model, the effect of interrelated structural deformation and combustion processes was taken into account by considering (1) transient, one dimensional mass, momentum and energy conservation equations in the gas phase; (2) a transient, one dimensional heat conduction equation in the solid phase; and (3) quasi-static deformation of the two dimensional linear viscoelastic propellant crack caused by pressure loading. This set of coupled, nonlinear, partial differential equations was solved numerically. This significance of dynamic burning propellant crack combustion was evaluated theoretically. The effects of pressurization rate, crack gap width, crack length, and propellant type one ignition and flame-spreading processes in isolated AP-based solid propellant cracks were studied. A solid propellant igniter system was developed to closely simulate actual rocket conditions. A high speed motion picture camera was used to measure the flame propagation rate. Good agreement was obtained between theoretical predictions and experimental observations. Dissert. Abstr.

N81-20215 Michigan Univ., Ann Arbor.
COMPARATIVE ADSORPTION PERFORMANCE OF SYNTHETIC ABSORBENTS AND ACTIVATED CARBONS Ph.D. Thesis
Benjamin Martinus vanVliet 1980 285 p
Avail: Univ. Microfilms Order No. 8106240

With respect to organic removal at trace levels, the activated carbons generally performed best, followed by the carbonaceous adsorbents and finally by the polymeric and resinous adsorbents. Polymeric adsorbents are unlikely contenders for potable water treatment applications; however, their performance at high waste concentration levels makes them attractive candidates for industrial applications. Different interaction mechanisms are evident for adsorption on the various adsorbents. Adsorbent particle shape and surface topography were found to have an important bearing on the dynamics of external mass transfer. A seven fold difference was manifest between the high efficiency values and the lowest value. Intraparticle transport dynamics were found to differ widely for the various adsorbents; surface diffusion coefficients differed as much as 40 fold. Dissert. Abstr.

N81-20216# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EXTRINSIC SPECIFIC HEAT OF PHOSPHORUS DOPED SILICON
M. Fabbri, I. C. daCunhaLima, and A. Ferreira daSilva Nov. 1980 14 p refs Submitted for publication
(INPE-1942-RPE/261) Avail: NTIS HC A02/MF A01

The theory of Matsubara and Toyozawa (MT) developed for impurity bands in semiconductors is investigated further in order to calculate the specific heat of Si:P. The effect of correlation as well as overlap on the electron hopping energy integral is taken into account via Heitler-London two particle wave functions. The calculated specific heat shows good agreement when compared to the experimental data over a wide range of impurity concentration around the critical value for metal-nonmetal transition. The comparison between MT and alternate molecular orbital MT calculations shows a big enhancement due to electron correlation. The results of the highly correlated electron gas model and inhomogeneity model are shown for the sake of comparison. Author

N81-20217*# National Aeronautics and Space Administration, Washington, D. C.
INFRARED SPECTRA OF SOME SULFIDES AND THEIR ANALOGS OF BINARY COMPOSITION IN THE LONG-WAVE REGION
A. S. Povarennykh, G. A. Sidorenko, L. S. Solntseva, and B. P. Solntsev Jan. 1981 18 p refs Transl. into ENGLISH from Mineral Sb. l'Vovskogo Gosudarstvennogo Univ. im. Iv. Franko, (USSR), v. 25, no. 4, 1971 p 306-315 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Academy of Sciences (USSR), Moscow
(Contract NASw-3199)
(NASA-TM-75901) Avail: NTIS HC A02/MF A01 CSCL 07D

The far infrared spectra (500-60/cm) of some simple sulfides and their analogs were studied. In all, 22 minerals with different structure types were investigated, out of which 14 are sulfides (galena, alabandite, pyrrhotite, sphalerite, wurtzite, cinnabar, realgar, orpiment, getchelite antimonite, molybdenite, pyrite, marcasite and heazlewoodite) 6 arsenides (niccolite, domeykite, arsenopyrite, lollingite, rammelsbergite and skutterudite), one telluride (tetradymite) and native arsenic. The main bands of infrared absorption spectra of the minerals are compared with the relative strength of the interatomic bonds and their interpretation is given. Author

N81-20218# Brown Univ., Providence, R. I. Dept. of Chemistry.
RAMAN SPECTRA OF HIGHLY CONDUCTING POLY-p-PHENYLENE COMPLEXES
Costas H. Tzinis, Ray H. Baughman, and William M. Risen, Jr. 15 Dec. 1980 23 p refs Submitted for publication
(Contract N00014-75-C-0883; NR Proj. 051-539)
(AD-A095660; TR-80-01) Avail: NTIS HC A02/MF A01 CSCL 07/4

The resonance Raman spectra of poly(p-phenylene) (PPP) and the highly conducting materials formed by doping it with the electron-donor Na (Na-PPP) or the electron acceptor AsF5 (AsF5-PPP) have been obtained. Doping with either type of dopant causes the C-C bond joining the phenyl-rings to become stronger and at least one of the in-ring bonds to become weaker, so all C-C bonds along the backbone of the pi-electron system become more alike than they are in the undoped PPP. The resonance enhancements show the relationship between changes in molecular configuration caused by optical transitions in the donor or acceptor doped PPP materials and the vibrational modes of the polymer. GRA

N81-20219# Stanford Univ., Calif. High Temperature Gasdynamics Lab.
DEVELOPMENT OF COMBUSTION DIAGNOSTICS AND APPLICATION TO TURBULENT COMBUSTION Final Report, 16 Feb. 1978 - 30 Sep. 1980
R. K. Hanson and C. T. Bowman Nov. 1980 17 p refs
(Contract F49620-78-C-0026; AF Proj. 2308)
(AD-A095719; AFOSR-81-0113TR) Avail: NTIS HC A02/MF A01 CSCL 21/2

Measurements with a tunable diode laser absorption system have been conducted in steady, fluctuating and sooting atmospheric-pressure flames produced in either a flat flame or a slot burner. Parameters measured include temperature, CO species concentration and CO spectroscopic parameters (line strengths and collision half widths). The measurements were made with two optical/tuning arrangements: by rapidly scanning the narrow-linewidth diode laser across individual vibration-rotation lines in the fundamental band of CO at 4.6 microns to record fully-resolved absorption line profiles in times as short as 100 microseconds; and by fixing the laser wavelength at the absorption line center and recording the absorption in real time. A conventional microprobe sampling system has been used to monitor CO and CO2 concentrations to enable comparisons between laser-based and conventional probe-based measure-

ments in steady flames; thermocouples have been used to allow comparisons with laser-based temperature measurements. Good agreement was found between the laser-based and probe based measurements of CO when the sampling probe was operated at low pressures, p - 8000 Pa (60 torr), but a substantial error in probe measurements, due to conversion of CO to CO2 interior to the probe, was observed at higher, more typical probe pressures. A tunable dye laser system for high-resolution absorption spectroscopy of combustion gases at visible and near-ultraviolet wavelengths has been developed. The system has been assembled and feasibility experiments involving measurement of sodium in a flat flame burner have been completed. GRA

N81-20220# Oklahoma Univ., Norman. School of Aerospace Mechanical and Nuclear Engineering.

COMBUSTION OF DROPS AND SPRAYS OF HEAVY FUEL OILS AND THEIR EMULSIONS Final Report, Sep. 1979 - Dec. 1980

S. R. Gollahalli, M. L. Rasmussen, and S. M. Salek Dec. 1980 212 p refs

(Contract DOT-CG-93621-A)

(AD-A095612; OU-AMNE-80-19; USCG-D-64-80) Avail: NTIS HC A10/MF A01 CSCL 21/2

An investigation was made to understand the combustion behavior of heavy fuels (No. 4 and No. 6 oils) and their emulsions. This study is an extension of an earlier study on a distillate fuel (No. 2) and its emulsion, and has been carried out in four parts: (1) study of emulsion characteristics; (2) single drop combustion experiments of No. 4 oil and its emulsions; (3) spray experiments of No. 4 and No. 6 oils and their emulsions; and (4) theoretical studied of single drop combustion. The effects of water content and the coupling influences of injection temperature, chamber temperature, chamber pressure, chamber oxygen content, and injector opening pressure are examined. The results show that unsupported drops of emulsions of heavy fuels with water also undergo fragmentation. Disruption time of emulsion drop increases with gravity of the fuel and decreases with the increases of injection temperature, chamber oxygen concentration, and chamber temperature. It is also seen to attain a minimum value at a water content of about 8% (by volume) under the conditions of this study. The completeness of combustion, soot, and nitrogen oxide emissions of the heavy fuel sprays are affected by emulsification. DOE

N81-20221# Connecticut Univ., Storrs. Dept. of Mechanical Engineering.

EFFECT OF ADDITIVES ON THE LEAN DETONATION LIMIT OF KEROSENE SPRAYS IN AIR Final Report, Mar. 1978 - Oct. 1979

E. K. Dabora Dec. 1980 56 p refs

(Grant DAAG29-78-G-0074)

(AD-A095190; UCONN-0507-129-F; ARO-15767.1-AE) Avail: NTIS HC A04/MF A01 CSCL 19/1

A shock tube technique was used to determine the lean detonation limit of arrays of kerosene in air when the kerosene is sensitized by either propyl nitrate or butyl nitrite. The technique, described in detail is used as a first step to determine the relationship between the detonation initiation energy and initiation power for stoichiometric H2 air mixtures at .5 atmosphere. It is found that if the initiation energy, E is expressed in J/sq cm and the power P, in Kw/sq cm, then (E -10) (P -27) = 555 J-K wcm to the 4th power. The method is also used to check on the lean limit of H2 air at atmospheric pressure. It was found that for an initiation energy of 50 J/sq cm at P = 160 Kw/sq cm (initiation M approx. 3.5), the lean limit is between 10-14% H2 in air. This value is somewhat lower than that found in the literature 18.2% H2 in air. Approximately the same energy and power were used to determine the lean limit of kerosene sprays. Monodisperse sprays having droplets diameter 780 microns were used. Three equivalence ratios were tested: .59, .44, and .3.3. Kerosene was mixed with 10% and 20% of either propyl nitrate (PN) or butyl nitrite (BN). Results indicate that addition of propyl nitrate reduces the limiting equivalence ratio, phi. GRA

N81-20222# Washington Univ., Seattle. Lab for Chemometrics.

THE GENERALIZED STANDARD ADDITION METHOD: INTERMETALLIC INTERFERENCES IN ANODIC STRIPPING VOLTAMMETRY Interim Report

R. W. Gerlach and Bruce R. Kowalski Feb. 1981 24 p refs Submitted for publication

(Contract N00014-75-C-0536; NR Proj. 051-565)

(AD-A095419; TR-19) Avail: NTIS HC A02/MF A01 CSCL 07/4

A barrier to routine application of anodic stripping voltammetry is the possible formation of intermetallic compounds which can lead to significant errors in the estimated analyte concentrations. As the well known method of standard additions can correct only for matrix effects it is powerless to correct for intermetallic interferences which are not matrix effects. By changing the experimental design, the new Generalized Standard Addition Method (GSAM) can simultaneously characterize and correct for this type interference as well as matrix effects expected for real samples. The method is tested on the Cu-Zn-Hg system and error estimates are provided for calculated linear response constants and analyte concentrations. GRA

N81-20223# National Bureau of Standards, Washington, D.C. Center for Fire Research.

IGNITION OF A LIQUID FUEL UNDER HIGH INTENSITY RADIATION Annual Progress Report, 1 Oct. 1979 - 30 Sep. 1980

Takashi Kashiwagi and Thomas J. Ohlemiller Nov. 1980 27 p refs

(Grant AF-AFOSR-ISSA-0010-80; AF Proj. 2308)

(AD-A095691; AFOSR-81-0111TR) Avail: NTIS HC A03/MF A01 CSCL 21/2

The time sequence of behavior of liquid fuel and of the fuel vapor near the liquid surface during the laser-induced ignition period was observed by high speed schlieren and direct photography. A CW carbon laser with fluxes up to 2500 watts per square centimeter was used; beam incident angles were 30 and 90 degrees with respect to the liquid surface. Both n-decane and l-decene were used as the liquid fuel. The pictures reveal, in the sequence, the formation of a radial wave, a central surface depression, bubble nucleation/growth/bursting followed by complex surface motion and further bubbling; typically several (or many) bubble cycles preceded ignition. Effects of laser flux level, incident laser angle and absorption coefficient of the liquid on the formation of bubbles, the size of bubbles, the frequency of bubble formation and the vaporization process are studied. A feasibility study of the use of two wavelength holographic interferometry to measure vapor concentration and its temperature during the ignition period has been undertaken. The design of a system to measure infrared absorption coefficients of liquid vapor at elevated temperature was completed. GRA

N81-20224# Indiana Univ. at Bloomington. Dept. of Chemistry.

REACTIONS OF METAL-METAL MULTIPLE BONDS. 8: FORMING Mo-Mo QUADRUPLE BONDS BY REDUCTIVE ELIMINATION (ALKYL GROUP DISPROPORTIONATION) IN THE REACTIONS OF 1,2-Mo2R2(NMe)4 COMPOUNDS (M TRIPLE BOND M) WITH CARBON DIOXIDE AND 1,3-DIARYLTRIAZENES

M. H. Chisholm, K. Folting, D. A. Haitko, and J. C. Huffman 30 Jan. 1981 34 p refs Submitted for publication

(Contract N00014-76-C-0826)

(AD-A095421; TR-81-1) Avail: NTIS HC A03/MF A01 CSCL 07/2

Addition of either CO2 or 1,3-diaryltriazines to 1,2-Mo2R2 (NMe2)4 compounds promotes reductive elimination from the dimetal center by alkyl group disproportionation with a concomitant metal-metal bond order change from three to four when R - an alkyl group having beta-hydrogen atoms. Both reactions proceed through intermediates of the form 1,2-Mo2R2 (NMe2)2 (chelate)2. The elimination of alkane and alkene is intramolecular and has a formal analogy with that found in mononuclear chemistry, namely beta-hydrogen elimination followed by reductive elimination by carbon-hydrogen bond formation. The detailed pathway leading to this is, however, uncertain. Finally, it should be recognized that it is not necessary to invoke the formation of an intermediate metal-hydride in these reactions. The beta-hydrogen atom of an ethyl ligand could be transferred to the alpha-carbon of the other ethyl ligand through

the agency of one of the nitrogen atoms, which could be either a triazenido or dimethyl-amido ligand. In a formal sense this would have analogy with E2 reactions of substituted alkanes. These, and other possibilities, provide us with the stimulus for further studies of reductive eliminations of hydrocarbons from dinuclear metal centers. GRA

N81-20225# Defence Research Establishment Suffield, Ralston (Alberta).

AN EXPERIMENTAL DEVICE FOR MEASUREMENT OF THE VISCOELASTIC PROPERTIES OF THICKENED LIQUIDS

W. J. Fenrick and G. A. Hill Nov. 1980 29 p refs
(AD-A095396; DRES-MEMO-1001) Avail: NTIS HC A03/MF A01 CSCL 14/2

A novel device for measuring the viscoelastic properties of thickened liquids has been built and tested at DRES. The device involves the withdrawal of a thin metal rod from the liquid under test. The variation in force applied to the rod as the filament of liquid between the rod and the liquid surface relaxes and separates is monitored by strain gauges and displayed on an oscilloscope. The oscilloscope traces provide force time signatures unique to each combination of viscosity and elasticity, which can be photographed and compared. The apparatus and its development are described in detail and oscillographic signatures obtained from various viscoelastic liquids are shown. Some initial theory is discussed and some recommendations are set forth. GRA

N81-20226# Castle Technology Corp., Lexington, Mass.

SURVEY OF ELECTROCHEMICAL PRODUCTION OF INORGANIC COMPOUNDS Final Report

J. Paul Pemsler and Robert A. Spitz Oct. 1980 145 p refs
(Contract W-31-109-eng-38)
(ANL/OEPM-80-3) Avail: NTIS HC A07/MF A01

The electrochemical generation of inorganic compounds, excluding chlorine/caustic, was critically reviewed. About 60 x 10 to the 12th power Btu/y fossil fuel equivalent will be used in the year 2000 for the electrosynthesis of inorganic compounds. Significant energy savings in chlorate production results from the development of suitable electrocatalysts for lowering the cathodic overpotential. Perchlorates, electrolytic hypochlorite, electrolytic manganese dioxide, fluorine and other miscellaneous compounds use relatively small amounts of electrical energy. Implementation of caustic scrubber technology for stack gas cleanup results in appreciable amounts of sodium sulfate which are electrolyzed to regenerate caustic. Hydrogen peroxide, now produced by the alkyl anthraquinone process, is made electrolytically by coupling anodic oxidation of sulfate with cathodic reduction of oxygen in alkaline solution. A novel energy efficient approach which uses an oxygen enhanced anodic reaction is examined. DOE

N81-20227# Duquesne Light Co., Pittsburgh, Pa. Dept. of Chemistry.

HYDROGEN BONDING IN ASPHALTENES AND COAL LIQUIDS Quarterly Report, 1 Aug. - 31 Oct. 1980

N. C. Li, L. Jones, and N. F. Yaggi 1980 37 p refs
(Contract DE-AC22-80PC-30252; Grant PHS-RR-00292)
(DOE/PC-30252/T1) Avail: NTIS HC A03/MF A01

A coal derived liquid (SRC-2) and its fractions were characterized by 600 MHz(1)H NMR spectrometer. The saturate fraction, being 8.1% by weight of unfractionated coal-liquid, is mainly composed of n-alkanes of high carbon numbers and the content of cycloalkanes is negligible. The aromatic fraction (49.0%) contains a considerable amount of partially hydrogenated polynuclear compounds. Double resonance techniques were used for chemical shift identification of beta-CH2 and alpha-CH2 protons attached to aromatic ring structures. The decoupled signals may be used for quantitative analysis of donor hydrogens, which are known to be effective in hydrogen transfer phenomenon in coal liquefaction processes. The aromatic fraction contains larger amounts of CH3 groups attached to condensed aromatic ring structures, which appear as singlets in the region of 2.4 to 2.7 ppM, whereas in acidic fractions almost all benzylic CH3 groups are attached to mono-aromatic ring structures. DOE

N81-20228# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Plant.

IMPROVED EMISSION SPECTROGRAPHIC FACILITY

C. R. Goergen, A. J. Letchco, G. B. Hosken, and D. R. Geckeler Oct. 1980 12 p Presented at the ANS Intern. Conf., Washington, D.C., 17-21 Nov. 1980
(Contract DE-AC09-76SR-00001)
(DPSPU-80-30-7; CONF-801107-45) Avail: NTIS HC A02/MF A01

The Savannah River Plant's original emission spectrographic labortory for radioactive samples had been in operation for 25 years. Due to deteriorated condition and the fire hazard posed by the wooden glove box trains, a project to update the facility was funded. The renovated laboratory improved efficiency of operation and incroporated numerous safety and contamination control features. DOE

N81-20229# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.

CHEMICAL AND CATALYTIC PROPERTIES OF ELEMENTAL CARBON

S. G. Chang, R. Brovzinsky, L. A. Gundel, and T. Novalov Oct. 1980 38 p refs Presented at General Motors Res. Lab. Conf., Particulate Carbon: Atmospheric Life Cycle, Warren, Mich., 12-14 Oct. 1980
(Contract W-7405-eng-48)
(LBL-11678; CONF-8010135-1) Avail: NTIS HC A03/MF A01

Elemental carbon particles resulting from incomplete combustion of fossil fuel are one of the major constituents of airborne particulate matter. These particles are a chemically and catalytically active material and can be an effective carrier for other toxic air pollutants through their adsorptive capability. The chemical, adsorptive, and catalytic behaviors of carbon particles depend very much on their crystalline structure, surface composition, and electronic properties. These properties are discussed and their relevance to atmospheric chemistry is examined. DOE

N81-20230# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.

CATALYTIC SYNTHESIS OF HYDROCARBONS OVER GROUP 8 OF THE REACTION MECHANISM METALS: A DISCUSSION

Alexic T. Bell Sep. 1980 45 p Prepared in cooperation with California Univ., Berkeley Submitted for publication
(Contract W-7405-eng-48)
(LBL-11339) Avail: NTIS HC A03/MF A01

Nonoxygenated rather than oxygenated intermediates may play a dominant role in the synthesis of hydrocarbons from CO and H2. Results obtained from the fields of surface science organometallic chemistry, and catalysis strongly support the hypothesis that hydrocarbon synthesis is initiated by the dissociation of CO and that the carbon atoms thus produced are hydrogenated to form adsorbed methylene and methyl groups. The latter species may be considered as precursors to methane as well as centers for hydrocarbon chain growth, a process which is postulated to begin by the insertion of a methylene group into the metal-carbon bond of a methyl group. The evidence leading to this view of Fischer-Tropsch synthesis is summarized and its implications for the synthesis of hydrocarbons are illustrated. Discussions are presented concerning the participation of olefins in secondary reactions which serve to alter the final distribution of products and the relationship of the mechanism of hydrocarbon synthesis to that for the synthesis of oxygenated products. DOE

N81-20231# Beet Sugar Development Foundation, Fort Collins, Colo.

TECHNICAL AND ECONOMIC FEASIBILITY OF MEMBRANE TECHNOLOGY Technical Progress Report, 17 Jul. - 16 Sep. 1980

Andrew M. Sandre (American Crystal Sugar Co.) Oct. 1980 47 p
(Contract DE-AC03-79CS-40213)
(DOE/CS-40213/T1; TPR-4) Avail: NTIS HC A03/MF A01

Progress is reported on the investigation of the potential application of reverse osmosis, ultrafiltration, and electrodialysis to the system of solids concentration in beet sugar process streams. During this period, emphasis was put on running reverse osmosis tests with a prototype machine to select the most

suitable membranes for the concentrating of sugar solutions. An economic analysis of using reverse osmosis in a factory producing 1 million gal/day of thin juice is discussed. DOE

N81-20232# Brigham Young Univ., Provo, Utah.
ALLOY CATALYSTS WITH MONOLITH SUPPORTS FOR METHANATION OF COAL-DERIVED GASES Final Technical Progress Report, 20 Sep. 1977 - 20 Sep. 1980
Calvin H. Bartholomew 5 Oct. 1980 128 p refs
(Contracts DE-AS01-77ET-10505; EF-77-S-01-2729)
(FE-2729-11) Avail: NTIS HC A07/MF A01

The activity, selectivity and stability of alumina supported nickel and nickel bimetallics in methanation of CO is investigated. Support geometry, in situ H2S poisoning tests, and carbon deposition tests are discussed. The results show that: (1) at high conversions and high throughput conditions monolithic supported catalysts are more active than pellet supported catalysts; (2) Ni-MoO3 is more active and sulfur resistant than Ni; and (3) in carbon deposition tests Ni-Pt and Ni-Co maintain catalytic activity longer than Ni. High temperature reactor tests reveal that catalysts prepared in this laboratory are more active and in some cases more thermally stable than commercial catalysts and that carbon deposition is a major factor but not the only factor causing deactivation at high temperatures. A comprehensive investigation of methanation kinetics over nickel (and to a lesser extent ruthenium) and deactivation by carbon was conducted. Effects of temperature, H2S concentration, and other reaction variables on the sulfur poisoning rate of nickel were also investigated. DOE

N81-20233# Los Alamos Scientific Lab., N. Mex.
ULTRAVIOLET LASER PHOTOCHEMISTRY OF HALOGENATED METHANES
F. B. Wampler, J. J. Tiee, and R. C. Oldenborg 1980 15 p refs Presented at the Electro-Optics/Laser Conf., Boston, 19-21 Nov. 1980
(Contract W-7405-eng-36)
(LA-UR-80-2798; CONF-801139-1) Avail: NTIS HC A02/MF A01

The uv laser photochemistry of CF2Br2, CCl4, CCl3F, and CCl2F2 was studied. The emission spectra and dynamics of the halogenated alkyl radicals formed from the excimer laser photolysis of these compounds are reported. Possible mechanistic routes are also examined. Some results are given from studies on the kinetics of CCl, CCl2, and CClF ground state radicals with various reactants. DOE

N81-20234# Sandia Labs., Albuquerque, N. Mex.
REACTION RATES OF ATMOSPHERIC GASES WITH LITHIUM (SILICON) ALLOY
Jimmie Q. Searcy and Fred W. Reinhardt Dec. 1980 43 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-1363) Avail: NTIS HC A03/MF A01

Reaction rates of small pellets of Li(Si) alloy with atmospheric gases were studied as a prerequisite to specifying how this alloy should be handled during the production of thermal batteries. The results indicate that Li(Si) reacts with oxygen and nitrogen at ambient conditions too slowly to be of concern, but it reacts very rapidly with water vapor. Rate expressions and constants are developed that allow calculating the weight gain of Li(Si) after its reaction with water vapor, and calculated values are given for three water vapor concentrations that typify those used in dry rooms where thermal batteries are produced. DOE

N81-20235# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.
SELECTED PHYSICAL AND THERMAL PROPERTIES OF VARIOUS FORMULATIONS OF SILICONE POTTING COMPOUNDS
Gary L. Flowers, Bill D. Faubion, Jackie L. Montague, and Susan T. Switzer Nov. 1980 17 p refs
(Contract DE-AC04-76DP-00487)
(MHSMP-80-63) Avail: NTIS HC A02/MF A01

Some of the physical and thermal properties are presented of materials developed as substitutes for additional cured silicone potting compounds which are no longer produced. The six raw materials tested were: Sylgard 186; Sylgard 184; Q36527 Dielectric Gel; Q3-6559 Accelerator; DC-1107; and Cabosil MS-75. Test data are reported for disk or punch shear strength; lap shear strength; but tensile strength; compressive strength; bulk tensile strength; durometer hardness; dynamic shear modulus; density; crosslink density; coefficient of thermal expansion; thermal conductivity; specific heat; and thermal diffusivity. All samples were prepared and cured at 25 C. Unless otherwise stated, all samples were tested at 25 C after a minimum cure time of 30 days. DOE

N81-20236# Ford Motor Co., Dearborn, Mich.
HC QUENCH LAYER FORMATION IN COMBUSTION PROCESSES Technical Progress Report, May - Nov. 1980
G. A. Lavoie Dec. 1980 15 p refs
(Contract DE-AC04-79ET-15303)
(DOE/ET-15303/T5) Avail: NTIS HC A02/MF A01

Wall quenching and other processes responsible for surface generated hydrocarbons in combustion under engine-like conditions are studied includimg the effects of turbulence on the evolution of hydrocarbons. The work tasks are (1) combustion bomb experiments to measure the effect of turbulence on the chemical species near the cold surface; (2) combustion bomb experiments using a similar turbulence generating device to fully characterize the flow and turbulence in the vicinity of the quenching surface; and (3) and analytical study of characterize fluid mechanical scales of interest in the boundary layer and to find an analytical solution to describe the evolution of the layer. DOE

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N81-20237 Wisconsin Univ. - Madison.
COMPUTER EVALUATION OF SURFACE TOPOGRAPHY (CEST) AND APPLICATIONS TO SHEET STEEL FINISHING PROCESSES Ph.D. Thesis
Abdel Rahman Nasr Shuaib 1980 190 p
Avail: Univ. Microfilms Order No. 8025852

A computerized technique, called the Computer Evaluation of Surface Topography (CEST), for the characterization of homogeneous random surfaces, is developed. The CEST technique represents the distributions of the variance of heights, slopes and curvatures by second order conic sections whose parameters quantitatively determine the nature of the respective distribution, the degree of isotropy and the directionality of the surface property. A self-contained package is developed consisting of a profile data acquisition setup and computer programs for computing the surface conic parameters and mapping the distribution. The developed CEST technique is applied for the quantitative evaluation of the changes in the topographic properties accompanying various finishing processes. These processes include rolling-mill finish, polishing, abrasive blasting and phosphate coating. Dissert. Abstr.

N81-20238 Florida Univ., Gainesville.
THE DEFORMATION OF GRAINS DURING COLD-ROLLING Ph.D. Thesis
Robert August Ellis, Jr. 1980 320 p
Avail: Univ. Microfilms Order No. 8105574

Quantitative metallographic techniques were used to study the changes in the shapes of the grains in aluminum, iron, titanium and zirconium samples during cold rolling. The grains deformed in much the same way as the bulk pieces of metal, becoming longer, wider and thinner in appearance. However, the quantitative measurements revealed that the deformation of the grains not exactly the same as that of the bulk; the measurements indicated that the grains tended to be shorter, wider and thicker than expected from the changes in the dimensions of the bulk samples. The differences between the measurements and the expected values appear to be due to deficiencies in the models used to describe grain deformation. These models are usually based on average grains, each of which deforms in exactly the same way as the bulk. It is shown that a model in which some grains deform less than the bulk, while others deform more,

exhibits the same descripancies in the measurements which were seen experimentally. Dissert. Abstr.

N81-20239 Wisconsin Univ. - Madison.
KINETICS OF THE DEGRADATION OF TYPE 316 STAINLESS STEEL BY LIQUID LITHIUM Ph.D. Thesis
Donald George Bauer 1980 647 p
Avail: Univ. Microfilms Order No. 8023397

A forced convection loop was used to study the corrosion of type 316 stainless steel by liquid lithium at temperatures relevant to fusion reactors. Weight loss data are reported for tubular samples located in the hot zone of the loop. Temperatures of 440 C and 490 C were used in the hot zone with temperature differences of 100 C and 200 C between the hot and cold zones. The effect of lithium velocity on local mass transfer rates was examined by simultaneously exposing stainless steel samples to parallel streams of lithium at velocities ranging from 40 to 130 cm/s. The loss rates became essentially steady after one month of exposure. It was presumed that particles of iron circulate in the lithium and by their dissolution and precipitation act as a buffer to reduce the wall fluxes. The loss rate increased with lithium velocity in a manner suggestive of liquid phase controlled mass transfer. The velocity dependence was weaker than expected for flows in the range of Reynolds numbers studied. This may reflect a significant interfacial resistance to the dissolution. Dissert. Abstr.

N81-20240 Virginia Univ., Charlottesville.
MICROSCOPIC PROCESSES IN THE DUCTILE FRACTURE OF PRECIPITATION HARDENED A1-1.79 w/o Cu ALLOYS Ph.D. Thesis
Ignatius Yuen-Tak Chan 1980 154 p
Avail: Univ. Microfilms Order No. 8101052

The effect of second phase inclusions on the mechanisms of ductile fracture was investigated through electron microscopy. The materials involved in this investigation were A1-1.79 w/o Cu alloys aged appropiately to contain either semi coherent theta prime or incoherent theta precipitates. Microcrack initiation sites most commonly were found at dislocation boundaries rather than at precipitate matrix interfaces. The dislocation boundaries at the crack edge were determined to be effectively low angle boundaries. The results indicated that the precipitates influenced the development of dislocation patterns during the workhardening stage, but only played a minor role in the final process of microcrack initiation. Consistent with the observations of the present investigation, the comparison between the estimated available energy for decohesion from dislocation boundaries and interfacial energies predicts the dislocation boundaries to be the favorable decohesion sites. Dissert. Abstr.

N81-20241 Michigan Univ., Ann Arbor.
CONCENTRATION DEPENDENT THERMAL RELEASE OF HELIUM-3 IMPLANTED IN MOLYBDENUM Ph.D. Thesis
William Guy Halsey 1980 169 p
Avail: Univ. Microfilms Order No. 8106149

The very high temperatures required to release helium from the sample indicates tight binding of helium to the lattice, probably at trapping sites composed of lattice defects. This view is supported by a lack of diffusion broadening in the implanted profiles as they were annealed, which indicates a trapping/detrapping controlled behavior. An interesting effect reported previously in other metals and documented here in molybdenum is an apparent concentration dependent release initiation with concentration independent continuation of release. This is indicated when a high dose sample releases helium until the amount remaining is much below a medium dose sample which has not begun to release helium at the same temperature. This effect, and the appearance of small holes in the sample surface, are taken as evidence for a collective release mechanism, such as bubble migration to the surface. Other effects observed include preferential helium release at grain boundaries and a crystallographic orientation dependence in the release. A sequence of events is proposed to model the behavior of helium implanted into molybdenum and annealed. Dissert. Abstr.

N81-20242 Houston Univ., Tex.
EFFECTS OF HYDROGEN ON THE ELASTIC CONSTANTS OF VANADIUM AND PALLADIUM SINGLE CRYSTALS Ph.D. Thesis
Chi-Ren Clarence Ko 1980 94 p
Avail: Univ. Microfilms Order No. 8103611

In the alpha phase of the V-H system, the changes in the absolute values of C' and CL were found to be linear with negative slopes of 2.0 percent and 0.5 percent/at. percent H respectively. The changes in C(44) in the alpha phase varied between 0 and 0.5 or 0.9 percent. The bulk modulus and the Voight-Reuss average Young's modulus in that phase were found to decrease 0.70 percent and 0.65 percent/at. percent H respectively. In the alpha phase of the Pd-H system, however, the changes in the absolute values of the elastic constant C(11), C(44) and C(L) were very small, while a comparatively larger effect of -1.2 percent/at. percent H was obtained in case of the shear constant C'. The elastic constants of vanadium in the temperature range of the alpha phase exhibited no change in their temperature dependences due to the addition of hydrogen on the temperature dependences of the elastic constants of palladium were found to be significantly large in case of C(11) and CL and small in the case of the shear constants C' and C(44). Dissert. Abstr.

N81-20243 Michigan Univ., Ann Arbor.
MECHANISM OF WORK HARDENING IN HADFIELD MANGANESE STEEL Ph.D. Thesis
Yezdi Noshir Dastur 1980 140 p
Avail: Univ. Microfilms Order No. 8106125

Hadfield manganese steel in the single-phase austenitic condition, when strained in tension exhibited jerky (serrated) flow, a negative (inverse) strain-rate dependence of flow stress and high work hardening in the temperature range -25 C to 300 C, characteristic of dynamic strain aging. The strain rate-temperature regime of jerky flow was determined and the apparent activation energies for the appearance and disappearance of serrations were found to be 104 kJ/mol and 146 kJ/mol, respectively. The work hardening decreased above 300 C because of the cessation of dynamic strain aging and increased again above 400 C because of precipitation of carbides. Static strain aging experiments indicated that a Snoek-type strengthening mechanism operated below 300 C. It is concluded that dynamic strain aging, brought about by the reorientation of carbon members of C-Mn couples in the strain fields of dislocations, is the principal cause of rapid work hardening in Hadfield steel. Dissert. Abstr.

N81-20244*# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
PASSIVATION OF CARBON STEEL THROUGH MERCURY IMPLANTATION Final Report, 1 Feb. 1980 - 1 Feb. 1981
Paul J. Wilbur and Raymond S. Robinson Feb. 1981 36 p refs
(Contract NAG3-25)
(NASA-CR-165292) Avail: NTIS HC A03/MF A01 CSCL 11F

An experiment, in which carbon steel samples were implanted with mercury ions from a broad beam ion source and their corrosion characteristics in air were evaluated, is described. Mercury doses of a few mA min/square cm at energies of a few hundred electron volts are shown to effect significant improvements in the corrosion resistance of the treated surfaces. In a warm moist environment the onset of rusting was extended from 15 min. for an untreated sample to approximately 30 hrs. for one implanted at a dose of 33 mA min/square cm with 1000 eV mercury ions. Author

N81-20245*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF GEOMETRIC VARIABLES ON RUB CHARACTERISTICS OF Ti-6Al-4V
Robert C. Bill, Jan Wolak (Washington Univ., Seattle), and Donald W. Wisander Apr. 1981 21 p refs Prepared in cooperation with Army Aviation Research and Development Command, Cleveland, Ohio
(NASA-TP-1835; AVRADCOM-TR-80-C-19; E-449) Avail: NTIS HC A02/MF A01 CSCL 11F

Experiments simulating rub interactions between Ti-6Al-4V blade tips and various seal materials were conducted. The number of blade tips and the blade tip geometry were varied to determine their effects on rub forces and on wear phenomena. Contact

was found to be quite unsteady for all blade tip geometries except for those incorporating deliberately rounded blade tips. The unsteady contact was characterized by long periods of rubbing contact and increasing blade tip that terminated in sudden rapid metal removal, sometimes accompanied by tearing and disruption of porous seal material under the rub surface. A model describing the blade tip loading is proposed and is based on the propagation of an elastic stress wave through the seal material as the seal material is dynamically compressed by the blade tip leading edge. E.D.K.

N81-20246# Naval Research Lab., Washington, D. C. Thermostructural Materials Branch.

DEFORMATION MICROSTRUCTURE DEVELOPED DURING FATIGUE CRACK PROPAGATION IN TYPE 316 STAINLESS STEEL AT 593 DEG C Interim Report

D. J. Michel and H. H. Smith 23 Feb. 1981 14 p refs (RR02241)

(AD-A095387; NRL-MR-4452) Avail: NTIS HC A02/MF A01 CSCL 11/6

The failure modes and dislocation substructure produced by fatigue crack propagation at 593 C in fast neutron irradiated and unirradiated Type 316 stainless steel were studied. The results indicate that the dislocation substrate produced by the crack propagation during both cyclic and combined cyclic-static loading conditions was directly dependent on the extent of matrix deformation as reflected by the mode of crack propagation. The results are consistent with the activation of either grain boundary or matrix mechanisms for deformation, as related to loading conditions, at the temperature investigated. The influence of neutron irradiation was to alter the operation of the basic deformation mechanisms by the increased difficulty of matrix dislocation motion resulting from the irradiation-induced defect production. GRA

N81-20247# TRW, Inc., Cleveland, Ohio.

FORGING OF POWDER METALLURGY GEARS Final Report, Apr. 1978 - Feb. 1980

B. Ferguson and Don T. Ostberg May 1980 84 p refs (Contract DAAK30-78-C-0029)

(AD-A095556; TRW-ER-8037-F; TARADCOM-TR-12517) Avail: NTIS HC A05/MF A01 CSCL 11/6

The objective of this program was to produce a very near-net shape spur gear by isothermal forging of a powder metallurgy 4600 grade preform. Die fill and densification on test coupons were complete at a forging temperature of 1650 F (900C), pressure of 10 tsi (140 MPa) with a dwell time of 15 min. Materials processed in this manner exhibited toughness and ductility, comparable to that in cast/wrought material. Composite preforms consisting of a P/M gear and a wrought shaft were cold isostatically pressed and sintered. Forging dies were EDM in cast IN-100 blocks. During the forging trials, however, serious problems of lubrication and die release were encountered. As a consequence, no successful forgings were produced. GRA

N81-20248# Brown Univ., Providence, R. I. Engineering Materials Research Lab.

SIMULTANEOUS STRESS RELAXATION IN TENSION AND CREEP IN TORSION OF 2618 ALUMINUM AT ELEVATED TEMPERATURE

James S. Lai and William N. Findley Oct. 1980 35 p refs (Grant DAAG29-79-G-0185)

(AD-A095410; EMRL-76; ARO-15508.5-E; TR-3) Avail: NTIS HC A03/MF A01 CSCL 11/6

Experiments are reported for stress relaxation and simultaneous stress relaxation and creep with proportional and non proportional loading and unloading. Results were compared with predictions of a viscous-viscoelastic theory, and modifications, and strain hardening. Predictions were calculated from results of combined constant-stress tension and torsion creep and recovery tests only, which were reported previously. Results showed that a modified viscous-viscoelastic theory predicted all the observed features and predicted the creep and relaxation rates reasonably well. GRA

N81-20249# Brown Univ., Providence, R. I. Dept. of Chemistry.

CONDUCTIVITY AS A TOOL FOR EVALUATING THE HOMOGENEITY OF SINTERED DISCS OF TRANSITION METAL OXIDES

Robert Kershaw, Bijan Khazai, Hector Leive, Kirby Dwight, and Aaron Wold 18 Feb. 1981 11 p refs (Contract N00014-77-C-0387)

(AD-A095298; TR-13) Avail: NTIS HC A02/MF A01 CSCL 07/2

Sintered discs can be prepared and made conducting for a number of transition metal oxides. It can be shown that room temperature resistivity measurements are an important tool in determining reproducibility for such materials. Several transition metal oxide systems have been chosen to illustrate the importance of these measurements. GRA

N81-20250# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.

A CONTINUOUS CORROSIVITY MONITORING DEVICE FOR NAVAL ENVIRONMENTS Progress Report

Vinod S. Agarwala 12 Nov. 1980 25 p refs (WR0220101)

(AD-A095728; NADC-80198-60) Avail: NTIS HC A02/MF A01 CSCL 07/4

Based on the principles of an electrochemical galvanic cell, a probe, with related data recording system, has been adopted for continuous monitoring of the corrosivity of naval environments. The probe has been used successfully to monitor the corrosivity on an aircraft carrier during an eight-month deployment. Current transients recorded during this period were analyzed and related to similar measurements made in controlled laboratory environments containing high humidity, chloride or chloride/SO2. GRA

N81-20251# Pennsylvania State Univ., University Park. Applied Research Lab.

THE HIGH RESOLUTION IMAGING ATOM-PROBE WITH APPLICATION TO NICKEL PLATINGS Ph.D. Thesis

Michael Martinka 17 Dec. 1980 181 p refs (Contract N00024-79-C-6043)

(AD-A095254; ARL/PSU/TM-80-242) Avail: NTIS HC A09/MF A01 CSCL 11/6

The development of a high resolution imaging atom probe time of flight mass spectrometer, its performance, and its application to electro and electroless nickel, nickel phosphorus platings, and to hydrogen adsorbed on rhodium. An imaging atom probe displays the distribution over a sample's surface of a constituent mass species selected from the sample's time of flight spectra. Imaging of the sample surface is at atomic resolution by field ion, desorption, and gated desorption microscopy. The mass resolution of this 13.5 cm flight path instrument was significantly increased by minimizing dispersion in the initial energy of field evaporated ions while improving timing and gating electronics. A preliminary application to the chemistry of hydrogen absorbed on metallic solids displayed crystallographically and atomically specific variations in the distribution of absorbed hydrogen over an undisturbed rhodium surface in an applied electric field. The principle application is the atomic level metallurgical analysis of stripped Ni and Ni P electron and electroless deposited plates. GRA

N81-20252# Lehigh Univ., Bethlehem, Pa. Center for Surface and Coatings Research.

CORROSION CONTROL THROUGH A BETTER UNDERSTANDING OF THE METALLIC SUBSTRATE/ORGANIC COATING/INTERFACE Annual Report, 1 Sep. 1979 - 31 Aug. 1980

Henry Leidheiser, Jr., Mohamed S. El-Aasser, Frederick M. Fowkes, Michael C. Hughes, John Manson, Fortunato J. Micale, David A. Thomas, Gary W. Simmons, and John W. Vanderhoof 1 Dec. 1980 255 p refs (Contract N00014-79-C-0731)

(AD-A095420; AR-1) Avail: NTIS HC A12/MF A01 CSCL 11/3

Many different characteristics determine the protective qualities of organic coating/metal substrate systems exposed to a corrosive environment. This research focuses on the following properties: (a) the oxided surface to which a coating is applied; (b) the stability of the coating/substrate adhesion under adverse conditions; (c) solid/polymer adhesion in terms of the acid and base character of substrate, pigment, filler, and po[illegible]

(d) chemical changes at the substrate/coating interface as a function of time; (e) film-forming mechanisms as they relate to protective properties; (f) morphological characteristics of organic coatings; (g) mechanical properties of organic coatings; (h) effect of pigments and fillers on film properties; and (i) electrical properties of organic coatings as they relate to corrosion behavior. Some of the studies represent direct attacks on understanding these properties and others represent preliminary stages. GRA

N81-20253# Drexel Univ., Philadelphia, Pa. Coll. of Engineering.

MELT PURIFICATION VIA FILTRATION Interim Report, 1 Jan. - 1 Jul. 1980

D. Apelian, R. Mutharasan, and C. Romanowski Watertown, Mass. Army Materials and Mechanics Research Center Oct. 1980 65 p refs

(Contract DAAG46-79-C-0052; DA Proj. 1L1-62105-AH-84) (AD-A095414; AMMRC-TR-80-49) Avail: NTIS HC A04/MF A01 CSCL 11/6

Background on the mechanisms and kinetics of filtration is discussed and the mathematical model of liquid metal filtration proposed by Drexel is updated and further elaborated. The study using the apparatus developed for molten aluminum filtration has been extended to characterize the effect of filter media. The steel filtration apparatus and initial experimentation are described. The Low Temperature Model study has been completed and is described and discussed. Reference is made to future work in Aluminum and Steel filtration, another low temperature model and a math-model Inclusion Flow Trajectory. GRA

N81-20254# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.

THE MICROSTRUCTURAL AND PROPERTY CHANGES OF LASER TREATED ELECTRODEPOSITS

V. P. Greco Jan. 1981 30 p refs Presented at the 67th Ann. AES Conf. and Exhibit of Ind. Finishing, Milwaukee, 22-26 Jun. 1980

(AD-A095345; AD-E440108; ARLCB-TR-81001) Avail: NTIS HC A03/MF A01 CSCL 13/8

The use of the LASER as a tool to improve the properties of electrodeposits for wear and erosion resistance is introduced. The microstructures and microhardness of LASER treated electrodeposits of chromium (Cr) and duplex coatings of chromium over cobalt (Co) onto steel are shown. Cobalt as an underlay is shown to produce superior structures compared to chromium directly on steel which suffers from the formation of brittle phases at the chromium-steel interface. GRA

N81-20255# Douglas Aircraft Co., Inc., Long Beach, Calif.

METALLURGICAL CHARACTERIZATION OF SUPERPLASTIC FORMING Final Technical Report, 17 Sep. 1977 - 31 Mar. 1980

T. L. Mackay, S. M. L. Sastry, and C. F. Yolton Wright-Patterson AFB, Ohio AFML Sep. 1980 312 p refs Prepared in cooperation with Colt Industries, Inc., Pittsburgh, Pa.

(Contract F33615-77-C-5198; AF Proj. 2418) (AD-A095720; AFML-TR-80-4038) Avail: NTIS HC A14/MF A01 CSCL 11/6

A systematic characterization of the superplasticity for regular-grade Ti-6Al-4V, ELI-grade Ti-6Al-4V, simulated coil-rolled Ti-6Al-4V, Ti-3Al-2.5V, Ti-6Al-2Sn-4Zr-2Mo, Ti-8Al-1Mo-1V, and Ti-15V-3Cr-3Sn-3Al sheets with several different microstructures and texture was performed. The effects of alloy chemistry, grain size, volume fraction of constituent phases, and anomalous microstructures on the superplastic parameters were determined by incremental strain-rate, constant stress, constant strain-rate and biaxial constant stress cone-forming tests. The strain-rate time (or equivalently, strain) dependences of flow stress and strain-rate sensitivity were identified as the most important superplasticity parameters, with the continuous changes in alloy microstructures during superplastic deformation requiring proper consideration. In the alpha-beta and near-alpha titanium alloys, the flow stress decreases and necking resistance increase with decreasing grain size at 850 to 950 F with increasing strain and time the flow stress at constant strain-rate increases and the strain rate at constant applied stress decreases as a consequence of increasing grain size. GRA

N81-20256# Illinois Univ., Urbana. Dept. of Metallurgy and Mining Engineering.

STUDIES OF HYDROGEN EMBRITTLEMENT AND STRESS-CORROSION CRACKING IN AN ALUMINUM-ZINC-MAGNESIUM ALLOY

S. W. Ciaraldi, J. L. Nelson, R. A. Yeske, and E. N. Pugh 1980 11 p refs

(Contract DE-AC02-76ER-01198) (DOE/ER-01198/1325) Avail: NTIS HC A02/MF A01

Tensile tests were carried out on a high purity Al-5.6 Zn-2.6 Mg alloy hydrogenated by exposure to moist air. Results indicate that internal hydrogen embrittlement occurs by the formation and rupture of a stress-induced hydride at the grain boundaries. The hydride, identified by electron diffraction as AlH3, is shown to be unstable in laboratory air, reverting to aluminum. The hydride phase was not detected in specimens failed by SCC, despite evidence that hydrogen is transported ahead of advancing stress corrosion cracks, and this leads to the possibility that a basically different mechanism may be responsible for SCC in this alloy. DOE

N81-20257# Sandia Labs., Albuquerque, N. Mex.

INTERACTION BETWEEN COMPUTATIONAL MODELLING AND EXPERIMENTS FOR VACUUM CONSUMABLE ARC REMELTING

L. A. Bertram and F. J. Zanner 1980 19 p refs Presented at the Conf. on Modeling of Casting and Welding Processes, Runge, N.H., Aug. 1980

(Contract DE-AC04-76DP-00789) (SAND-80-1177C; CONF-800881-2) Avail: NTIS HC A02/MF A01

A combined computational-experimental modeling effort is currently underway to characterize the vacuum consumable arc remelt process. This effort involves the coupling of experimental results with a magnetohydrodynamic flow model which is capable of time accurate solutions of the interdependent fluid-flow-solidification process in the ingot. Models such as this are driven by boundary conditions. Considerable data were compiled from direct observation of the electrode tip and molten pool surface by means of high speed photography in order to gain an understanding of the processes at the pool surface and the appropriate corresponding boundary conditions. DOE

N81-20258# Battelle Pacific Northwest Labs., Richland, Wash.

RECOVERY AND USE OF FISSION PRODUCT NOBLE METALS

George A. Jensen, C. A. Rohmann, and L. D. Perrigo Jun. 1980 23 p refs Presented at the Am. Nucl. Soc. Ann. Meeting, Las Vegas, Nev., 9 Jun. 1980

(Contract DE-AC06-76RL-01830) (PNL-SA-8358; CONF-800607-9) Avail: NTIS HC A02/MF A01

Noble metals in fission products are of strategic value. Market prices for noble metals are rising more rapidly than recovery costs. A promising concept was developed for recovery of noble metals from fission product waste. Although the assessment was made only for the three noble metal fission products (Rh, Pd, Ru), there are other fission products and actinides which have potential value. DOE

N81-20259# Brookhaven National Lab., Upton, N. Y.

KINETICS OF HYDROGEN ABSORPTION-DESORPTION BY METALS

M. A. Pick 1980 16 p refs Presented at the Advanced Study Inst. on Metal Hydrides, Rhodes, Greece, 17 Jun. 1980

(Contract DE-AC02-76CH-00016) (BNL-28584; CONF-8006130-2) Avail: NTIS HC A02/MF A01

Experimental studies and a theoretical model for the potential energies involved with the hydriding-dehydriding process are reviewed. The theoretical model is discussed in detail and it is shown how it applies to the model substances Nb and Ta and how two major predictions of the model are fulfilled. One of the predictions deals with the surface modifications which can enhance the hydrogen uptake rate and a second one with the temperature, coverage and pressure dependence of the sticking coefficient. DOE

N81-20260# Los Alamos Scientific Lab., N. Mex.
CASTING PROCEDURE FOR BARIUM METAL CONES USED IN HIGH-ALTITUDE EXPERIMENTS
Lawrence F. Manker, Jr. Oct. 1980 9 p
(Contract W-7405-eng-36)
(LA-8517-MS) Avail: NTIS HC A02/MF A01

Graphite that is machined and treated was used to produce a mold to make barium cones. Iron, molybdenum, and zirconite are used as coatings during fabrication. The molds can be reused. DOE

N81-20261# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
PLATELET MECHANISM OF EROSION OF DUCTILE METALS
Robert Bellman, Jr. and Alan Levy Nov. 1980 16 p refs Presented at the Intern. Conf. on Wear of Materials, San Francisco, 31 Mar. - 1 Apr. 1981
(Contract W-7405-eng-48)
(LBL-11341-Rev; CONF-810301-1-Rev) Avail: NTIS HC A02/MF A01

A series of room temperature experiments was conducted to determine the mechanism of material removal when an erosive particle stream impacts on a ductile metal surface. Aluminums 1100-0 and 7075-T6 were used for the target and 600 micrometers SiC particles moving at a velocity of 100 fps in air for the eroding stream. It was determined that a combined forging extrusion mechanism that produces small, highly distressed platelets of target material that are knocked off the surface by succeeding particle impacts is responsible for erosion at both low and high impingement angles. The proposed mechanism is a significant departure from the previously believed micro-machining mechanism of erosion of ductile metals. DOE

N81-20262# Ames Lab., Iowa. Dept. of Materials Science and Engineering.
PREPARATION OF HIGH PURITY VANADIUM
O. N. Carlson, H. R. Burkholder, G. A. Martsching, and F. A. Schmidt 1981 14 p refs Presented at the AIME Extraction Met. of Refractory Metals Meeting, Chicago, Ill., 22-26 Feb., 1981
(Contract W-7405-eng-82)
(IS-M-305; CONF-810203-1) Avail: NTIS HC A02/MF A01

Reduction and refining methods used to prepare vanadium metal are discussed. Work on improving the scaling up the aluminothermic reduction process is described. Iron and silicon and first removed from commercial V205 by an ion exchange separation technique and the purified oxide is then exothermically reduced with aluminum metal. The resulting V-Al ingot is heated in a vacuum to 1700 (0)C to remove the aluminum and dissolved oxygen, and the sponge is then electron-beam melted to remove residual volatile impurities to yield vanadium metal of 99.98 percent purity. Precautions taken during each processing stage to minimize carbon, nitrogen and oxygen contamination are described. Experiments designed to scale up the reduction process and to increase the efficiency of the separation and melting steps are described. Various refining techniques applied to the preparation of high purity vanadium are described and comparisons made between the quality of metal obtained by each. DOE

N81-20263# Academy of Sciences (USSR), Moscow. Inst. of Metallurgy.
STRUCTURE AND PROPERTIES OF LIGHT ALLOYS
A. M. Korolkov, ed. New Delhi, India Amerind Publishing Co. Pvt. Ltd. 1980 217 p refs Transl. into ENGLISH from Struktura i Svoistva Legkikh Splavov (Moscow), 1980 221 p
(Contract DE-AI01-77ET-20344)
(TT-76-52003; ERDA-tr-75) Avail: NTIS HC A10/MF A01

The results of physico-chemical investigations on noble and light alloys, the development and adoption of the most promising alloys and their processing methods are discussed. These investigation cover construction of binary and ternary phase diagrams, study of the effect of doping content of elements on the structure and properties of noble and light alloys, study of the process of crystallization, decay of supersaturated solid solution, recovery and recystallization. Attention is given to the relation between various properties of alloys, e.g., mechanical, physical and others, and their structure as well the conditions of producing one or other of these structures. DOE

N81-20264# Delaware Univ., Newark.
RADIATION EFFECTS IN AMORPHOUS METALLIC ALLOYS Progress Report, 1 Feb. 1980 - 31 Jan. 1981
R. B. Murray, J. J. Kramer, and D. G. Onn Oct. 1980 16 p refs
(Contract DE-AC02-80ER-10571)
(DOE/ET-10571/3) Avail: NTIS HC A02/MF A01

Equipment was constructed to permit measurement of Curie temperatures in the range 77 K to 650 K. A melt spinner was constructed and ribbons of Fe(x)Ni(80-X)P(14)B(6) were fabricated for x = 20, 27, and 34. A beam line, target chamber, and necessary electronics were put together for electron irradiation. A series of proton irradiations was carried out on all 3 ribbons with protons of low energy that are implanted in the sample and with protons of high energy that completely penetrate the sample. A series of electron irradiations at 1.25 MeV was performed on the Fe(2) sample. Results show an increase in saturation magnetization as measured at 77 K, an increase in Curie temperature, and an increase in small angle X-ray scattering. The data indicate that the important variable is energy deposited, suggesting that the observed effects are due to localized energy deposition in the projectile path, perhaps radiation enhanced diffusion of phosphorous. E.D.K.

N81-20265# GEC Power Engineering Ltd., Whetstone (England).
INVESTIGATION INTO THE BEHAVIOR OF TITANIUM AND TITANIUM ALLOYS UNDER CAVITATIONAL STRESS
F. Erdmann-Jesnitzer and R. Laschimke Oct. 1980 37 p refs Transl. into ENGLISH of Sonderdruk aus Dechema-Monographien (West Germany), v. 45 p 329-352 In ENGLISH and GERMAN (GEC-TRANS-2071) Avail: NTIS HC A03/MF A01

The cavitation resistance of titanium alloys was investigated using a droplet impinger and by comparison with other materials. An 8 mm diameter water jet was broken up by a rotating double-armed vane to the ends of which were attached the plate-shaped test pieces. The impact speed was 72 m/sec. Weight of the polished samples was determined each 20 min on a chemical balance. The cavitation resistance of TiAl6V4 alloy can be significantly increased by appropriate heat treatment. The cavitation resistance of the Ti-alloys varies over a very wide range, but they still fall even in the most unfavorable case within the group of Cu and Fe considered as being cavitation resistant. Author (ESA)

N81-20266# Kraftwerk Union A.G., Mulheim (West Germany). Bereich Tecknik Werkstoffe.
LONG TIME CORROSION TESTING WITH AND WITHOUT MECHANICAL STRESS OF HIGH TEMPERATURE ALLOYS FOR THE BLADES OF HIGH OUTPUT LAND-BASED GAS TURBINES Final Report
Friedhelm Schmitz Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 106 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-106; ISSN-0340-7608) Avail: NTIS HC A06/MF A01

The corrosion resistance of nickel and cobalt based alloys was studied in the laboratory without and partly with simultaneous mechanical stress. High temperature tests without stress, performed for up to 4000 hours at temperatures of 700 C to 850 C, show the influence of the chrome content in the alloys. Of the nickel based alloys, the material IN 939 (23% Cr) had the greatest resistance to high temperature corrosion and among the cobalt alloys, the greatest resistance was found in FSX 414 (30% Cr). With simultaneous mechanical stress, creep strength was reduced in the forged alloy U 520. The high quality cast alloys IN 738 LC and U 500 showed no important reduction. A.R.H.

N81-20267# Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany). Hauptabteilung Werkstofftechnik.
EXAMINATION OF THE STRENGTH OF HIGH TEMPERATURE ALLOYS FOR GAS TURBINES IN HOT GAS ENVIRONMENTS Final Report
Wolfgang Track, Wolfgang Betz, and Klaus Schweitzer Bonn

Bundesministerium fuer Forschung und Technologie Dec. 1979 81 p refs In GERMAN; ENGLISH summary Presented at Conf. on High Temp. Alloys for Gas Turbines, Liege, 25-27 Sep. 1978 Sponsored by Bundesministerium fuer Forschung und Technologie
(Proj. BCT 31)
(BMFT-FB-T-79-150; ISSN-0340-7608) Avail: NTIS HC A05/MF A01

The strength of high temperature alloys at combined mechanical and corrosive stresses was investigated. Design criteria affecting construction of gas turbine blades are discussed. Service life was determined by comparing data from corrosion, creep, and low cycle fatigue (LCF) tests in air as well as in streaming hot gas varying corrosivity. The loss in residual room temperature strength of C 263 alloy and Hastelloy X after hot gas corrosion at 850 C to 950 C can be explained by the reduction in cross section and by aging. In streaming hot gas, the times of creep rupture of the alloys: IN 100, M 246, M 002, Inconel 713, IN 738 and IN 957, are reduced to 50% of those in still air. In hot gas with sea salt, the reduction is 80%. This is not explainable by the reduction in cross section due to corrosion. The use of Al diffusion or CoCrAly normal pressure plasma spray coatings reduces the creep life at high stresses, while Cr/Al diffusion coatings have no influence. Coating thickness > 50 microns reduces LCF lifetime. In setting specifications for the design of parts which are simultaneously exposed to mechanical and corrosive stresses, creep rupture data determined only in air are insufficient, even if the loss in cross section due to corrosion is taken into account. Author (ESA)

N81-20268# Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany). Hauptabteilung Werkstofftechnik.
TURBINE MATERIALS CHARACTERISTICS UNDER LOW CYCLE FATIGUE Final Report
Barbara Borchert and Wolfgang Betz Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 57 p refs In GERMAN; ENGLISH summary Presented at Conf. on High Temp. Alloys for Gas Turbines, Liege, 25-27 Sep. 1978 Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-151; ISSN-0340-7608) Avail: NTIS HC A05/MF A01

Durability and deformation characteristics of three alloys (Ti6Al4V; Inconel 718; waspaloy) for engine disks were investigated in the low cycle fatigue range. The service life of disks, estimated from these properties using the Neuber method, is checked against component test results. Alloy specimens were tested under simple load conditions (one-step-test, room temperature) to get the crack initiation line (strain controlled) and the cyclic sigma-epsilon curve for smooth geometries. Engine disk life was then measured under load in a cycle spin facility. To extend the results, stress controlled Woehler tests on notched specimens were performed. Comparison of disk life with Neuber predicted life shows good agreement, within a factor of two, with respect to shape and range of the sigma-N curves.
Author (ESA)

N81-20269# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
ENGINEERING PROPERTIES OF THE RECENTLY DEVELOPED ALUMINUM ALLOY DESIGNATED 7010
W. G. J. tHart and L. Schra Feb. 1979 54 p refs
(Contract NIVR-1743)
(NLR-TR-79017-U) Avail: NTIS HC A04/MF A01

Tensile, fracture toughness, stress corrosion crack growth, and fatigue tests were performed on 80 mm thick 7010-T7651 and 7010-T73651 aluminum alloy (Al Zn Mg Cu) plate. Comparison tests were made on 7075-T7351 plate material. Results of the standardized tests indicate that the fracture toughness properties of 7010 amply exceed the required minimum values. There is a relatively small difference between the fracture toughness in the L-T and T-L direction. Tests reveal that 7010 in the T7651 and T73651 tempers is resistant to stress corrosion cracking. The stress corrosion crack growth rate of 7010-T7651 under NaCl moistening is very low, and crack growth of 7010-T73651 was still smaller. Fatigue tests under flight simulation loading show that the material location through the plate thickness do not influence the fatigue behavior of the 7010 and 7075 alloys. Fatigue testing of 2-, 5-, 10-, and 15-mm thick specimens reveal a thickness effect which is most pronounced for the small thicknesses. The fatigue life decreased with increasing specimen thickness. The overall properties are somewhat better for 7075-T7351 than for 7010-T73651. Author (ESA)

N81-20270# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
ENGINEERING PROPERTY COMPARISONS FOR FOUR AlZnMgCu TYPE FORGING ALLOYS
L. Schra Apr. 1979 90 p refs
(Contract NIVR-1743)
(NLR-TR-79022-U) Avail: NTIS HC A05/MF A01

The engineering properties of the aluminum alloys AA7075-T73, AA7050-T736 and AZ74.61 were compared through destructive testing. Strength, fracture toughness, fatigue crack propagation under different load spectra, and resistance to stress corrosion cracking both with respect to initiation and propagation were examined. The alloy 7050-T736 exhibits the best overall performance, whereas AZ74.61 shows the poorest behavior. The properties of 7075-T73 and 7175-T736 are intermediate as compared to the former alloys, with higher strength and better fracture toughness for 7175-T736 and better to stress resistance corrosion cracking for 7075-T73. Author (ESA)

N81-20271# Indian Hot Dip Galvanizers Association, New Delhi.
GALVANIZING
Nov. 1980 24 p refs
(PB81-120271; Rept-26) Avail: NTIS HC A02/MF A01 CSCL 11C

Contents include: heating of galvanizing pots; control of pickling acids; painting galvanized steel; effluents from hydrochloric and pickling-problems and possible solutions; double rinsing in galvanizing; mechanical properties of galvanized steel; and inspection and testing of galvanized products. Industry news and recent literature on zinc coatings are presented. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N81-20272 Institute of Paper Chemistry, Appleton, Wis.
THE EFFECT OF OXYGEN AND ANTHRAQUINONE ON THE ALKALINE DEPOLYMERIZATION OF AMYLOSE Ph.D. Thesis
Folke Lennart Anders Arbin 1980 91 p
Avail: Univ. Microfilms Order No. 8105251

The homogeneous alkaline degradation of purified potato amylose was studied in terms of yield loss and shifts in the molecular weight distribution with respect to reaction time. These data allowed the modes of depolymerization to be identified and characterized. For anaerobic conditions, the results were consistent with the classical theory of alkaline degradation. There was no measurable random cleavage of polymer chains, while 290 and 400 glucose units were lost per molecule via the peeling mechanism at 80 and 100 C respectively. Degradation of amylose in oxygen alkali verified that oxygen affects the relative rates of the two modes of alkaline depolymerization. Oxygen provides additional pathways which terminate the peeling reaction, so that the average peeling length at 100 C was only about 5-8% (i.e., 20-30 glucose units) of what it was in the absence of oxygen. Anthraquinone affected the amylose degradation in a manner similar to molecular oxygen. The additive stabilized the amylose against peeling yield losses under nitrogen as well as oxygen atmospheres. The average peeling length in the presence of anthraquinone was estimated to be about 20-30 units under nitrogen and 10-15 units under oxygen. Dissert. Abstr.

N81-20273 Connecticut Univ., Storrs.
TOUGHENING OF EPOXY RESIN BY ACRYLIC ELASTOMER Ph.D. Thesis
Shmuel Gazit 1980 271 p
Avail: Univ. Microfilms Order No. 8106735

An improved method for the evaluation of the impact behavior of glassy polymeric materials was developed. The technique is

based on the measurements of both strain and stress of the tested plastic specimen in a tensile impact tests. The speed of the impact used was in the range of 1500 mm/sec, although a wide range of speeds is possible with the method. One improvement was the measuring of the strain of the specimen by a transducer that makes noncontacting measurements of distance. The readout of the two transducers was via a two channel digital oscilloscope, with high resolution and storage capability. Dissert. Abstr.

N81-20274 California Inst. of Tech., Pasadena.
THE MOTION OF MACROMOLECULES AND IMMISCIBLE DROPS IN CREEPING FLOW Ph.D. Thesis
William Lee Olbricht 1981 239 p
Avail: Univ. Microfilms Order No. 8105125

Experimental studies were conducted on the creeping motion of immiscible drops of a Newtonian liquid through a circular tube. The mobility of the drop, the additional pressure gradient owing to the presence of the suspended drop, and the deformation and breakup of the drop were determined as a function of the drop size, flow rate and viscosity ratio, for both Newtonian and viscoelastic suspending fluids. Two tube geometries were employed to generate kinematically distinct flows. The dynamics of fluid systems which are comprised of a suspended material in a Newtonian continuous phase were investigated theoretically. Two examples illustrate the approach: the micromolecular stretching induced by a turbulent flow and the breakup of immiscible liquid drops in a shear field. Dissert. Abstr.

N81-20275*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DYNAMICS OF SOLID DISPERSIONS IN OIL DURING THE LUBRICATION OF POINT OF CONTACTS. PART 2: MOLYBDENUM DISULFIDE
C. Cusano (Illinois Univ., Urbana-Champaign) and H. E. Sliney 1981 27 p refs Proposed for presentation at Ann. Meeting of the Am. Soc. of Lubrication Engr., Pittsburg, 11-14 May 1981
(NASA-TM-81709; E-410-2) Avail: NTIS HC A03/MF A01 CSCL 11H

A Hertzian contact consisting of a steel ball in contact with a glass disk is lubricated with MoS2 dispersions and observed by optical microscopy at various slide/roll conditions. In general the behavior of MoS2 and graphite are similar. That is, the solids tend to enter the contact and form a film on the contacting surfaces whenever a rolling component of motion is used, but solid particles seldom enter the contact during pure sliding. The MoS2 has more pronounced plastic flow behavior than graphite. However, the polished steel ball is more readily scratched by MoS2 than by graphite. Under the conditions of these studies, lower friction and wear are observed with pure oil rather than with the dispersions. However under other conditions (such as different contact geometry or rougher surfaces) the solid lubricant dispersions might be beneficial. E.D.K.

N81-20276*# Bowie State Coll., Md.
CHARACTERIZATION OF THE PHYSICO-CHEMICAL PROPERTIES OF POLYMERIC MATERIALS FOR AEROSPACE FLIGHT Annual Report
Michael Rock Mar. 1981 74 p
(Grant NsG-5009)
(NASA-CR-164062) Avail: NTIS HC A04/MF A01 CSCL 07C

Electrodes and electrolytes of nickel cadmium sealed batteries were analyzed. Different thermal analysis of negative and positive battery electrodes was conducted and the temperature ranges of occurrence of endotherms indicating decomposition of cadmium hydroxide and nickel hydroxide are identified. Atomic absorption spectroscopy was used to analyze electrodes and electrolytes for traces of nickel, cadmium, cobalt, and potassium. Calibration curves and data are given for each sample analyzed. Instrumentation and analytical procedures used for each method are described. J.D.H.

N81-20277# Pennsylvania State Univ., University Park. Applied Research Lab.
FOURIER TRANSFORM INFRARED SPECTROSCOPIC STUDIES ON THE THERMAL DEGRADATION OF POLYACRYLONITRILE COPOLYMERS M.S. Thesis
George T. Sivy 21 Nov. 1980 83 p refs
(Contract N00024-79-C-6043)
(AD-A095270; ARL/PSU/TM-80-227) Avail: NTIS HC A05/MF A01 CSCL 11/9

Poly(acrylonitrile) (PAN) and copolymers of PAN containing comonomers of vinyl acetate (VAc), methacrylic acid (MAA), acrylamide (AM) and other acrylics are important precursors to the formation of carbon fibers. Fourier transform infrared spectroscopy has proved to be an excellent technique with which to study where cyclization of the polymer chain takes place. A comparison of the rates of degradation of each of these copolymers at various temperatures and under reduced pressure is presented. This comparison indicates that each comonomer initiates cyclization of the nitrile groups, with the MAA and AM comonomers actually lowering the temperature at which the cyclization reaction occurs. Degradation mechanisms for each copolymer, consistent with the infrared results obtained under reduced pressure, are advanced. GRA

N81-20278# Electrochemical Technology Corp., Seattle, Wash.
DETERMINATION OF THE EFFECT OF COMPOSITION STRUCTURE AND ELECTROCHEMICAL MASS TRANSPORT PROPERTIES ON ADHESION AND CORROSION INHIBITION OF PAINT FILMS Annual Progress Report, 1 Nov. 1979 - 31 Oct. 1980
Robert T. Ruggeri and Theodore R. Beck Dec. 1980 111 p refs
(Contract N00014-79-C-0021)
(AD-A095293; ARP-2) Avail: NTIS HC A05/MF A01 CSCL 11/3

Mass transport properties of five different paints have been investigated. Water permeability coefficients have been obtained using ASTM methods. Water diffusion coefficients have been measured for two paints, a vinyl resin and a polyurethane. The results strongly suggest that the diffusivity changes with position across these paints. A permeability model encompassing these facts is presented. Permeability coefficients and transference number for the transport of sodium and chloride ions have been measured in one type of polyurethane paint. The evidence is that two thirds of the current passing through the polyurethane films is not carried by either sodium or chloride. A model has been proposed in which the additional current is carried by ions resulting from dissociation of a neutral compound. The transport parameters will be related to chemical and structural properties of the paints to obtain a fundamental understanding of the corrosion mechanism. GRA

N81-20279# Mound Lab., Miamisburg, Ohio.
CERMET-BONDED METAL PINS FOR WELDABLE ELECTRICAL FEEDTHROUGHS IN ALUMINA
M. D. Kelly 1981 13 p Presented at the 5th Ann. Conf. on Composites and Advan. Mater., Cocoa Beach, Fla., 18 Jan. 1981
(Contract DE-AC04-76DP-00053)
(MLM-2796(OP); CONF-810108-1) Avail: NTIS HC A02/MF A01

An engineering technique to insert metal pins through the alumina body while maintaining the benefits of the cermet was developed. In this two step process, metal tubes (molybdenum) are inserted into holes drilled in a green Mo/Al2O3 cermet and sintered in place. Then, copper or Kovar metal pins are diffusion bonded in these tubes. The metal pins form electrical feedthroughs which are more conductive, stronger, and require fewer processing steps than the present methods of using cermet feedthroughs. DOE

N81-20280# Purdue Univ., Lafayette, Ind.
MECHANISMS OF ELEVATED TEMPERATURE RUPTURE IN SINGLE PHASE CERAMICS Progress Report, 1 Mar. 1980 - 31 Jan. 1981
A. A. Solomon Oct. 1980 37 p
(Contract DE-AC02-80ER-10591)
(DOE/ER-10591/1; COO-10591-1) Avail: NTIS HC A03/MF A01

The constant true stress tensile creep system was assembled and is largely operational. Fabrication of suitable tensile specimens proceeded using slip casting and punch and die forming. UO2

swelling experiments were initiated. Evidence suggests that tungsten oxides are acting as contaminants in UO2. Initial swelling and gas release measurements using the quadrupole mass spectrometer system were performed. Ni using as representative of pure ductile materials with intragranular porosity and large grains. Large swelling strains of approximately 20 percent were observed prior to gas release, the magnitude varying inversely with the internal pressure. The maximum in the swelling rate coincides with the maximum in the gas release rate. The measured total gas released agrees fairly well with the amount of entrapped gas, assuming the pores close uniformly at 87 percent TD. Microstructural examination shows interlinked pores after release. DOE

N81-20281# Daimler-Benz A. G., Stuttgart (West Germany). Zentrale Forschung.

CERAMIC COMPONENTS FOR GAS TURBINES Final Report

Eberhard Tiefenbacher and Wilfried Raeuchle Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 152 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-79-153; ISSN-0340-7608) Avail: NTIS HC A08/MF A01

Ceramic, gas turbine parts and ceramic coated parts were designed, manufactured and tested. Thermodynamic properties along with thermal and mechanical loads were determined for a recuperator and for a turbine rotor design, small recuperator matrix samples were tested. Results show satisfactory thermoshock behavior. A ceramic vacuum deposition process was developed to a stage where small parts can be coated with a dense layer of Si3N4. A number of turbine rotor hubs and biodes were coated and tested. Results meet high temperature design criteria under axial load. A complete monolithic turbine rotor was manufactured by an isototic hot pressing process. This rotor was successfully spin tested. Author (ESA)

N81-20282# Max-Planck-Institut fuer Metallforschung, Stuttgart (West Germany). Pulvermetallurgisches Lab.

INVESTIGATIONS ON PROCESSING AND PROPERTIES OF HIGH-TEMPERATURE SILICON CARBIDE MATERIALS Final Report

Ludwig J. Gauckler, Gerhard Schneider, and Juergen Ruska Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 172 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-79-170; ISSN-0340-7608) Avail: NTIS HC A08/MF A01

A computer program for determination of phase equilibria of SiC with A1 and B was written, using all necessary and available thermodynamic data. Experimental results of phase equilibrium investigations in the system S1, A1 He/C, N are presented in isothermal sections. Eight newly found compounds were characterized with respect to chemical composition and crystal symmetry. For the quantitative determination of the most frequent SIC polytype fractions (3C, 4H, 6H, 15R) an equation system was established, using peak heights from powder diffraction patterns. Author (ESA)

N81-20283# Max-Planck-Institut fuer Metallforschung, Stuttgart (West Germany). Pulvermetallurgisches Lab.

INVESTIGATION OF FABRICATION, COMPOSITION AND PROPERTIES OF NEW HIGH TEMPERATURE CERAMICS BASED ON SILICON NITRIDE Final Report

Ludwig J. Gauckler Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 156 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-79-174; ISSN-0340-7608) Avail: NTIS HC A08/MF A01

The constitution of Si Al Be/N O complex systems was investigated at temperatures between 1650 and 1760 C. Phase equilibria of the systems Si A1/N O. Si Be/N O, and Si Mq A1/N O are described. The extent to which silicon nitride forms mixed crystal rows is established. The amalgamation of aluminum and beryllium containing systems was characterized. This stoichiometric approach to mixed crystals is extended to develop a bulk variety of aluminum nitride and beryllium nitride. Results concerning the existence and extent of melt phase zones in the Si, A1/N O system are applied to the definition of a reaction sintering method with transient liquid during densification. Dense beta Si3N4 solid solution specimens are obtained which approach theoretical expectations to within 98%. The influence of aluminum oxide content on mechanical and thermal properties was then determined. Measurement results for thermal expansion, thermal conductivity, oxidation resistance. Youngs modulus, strength, and thermal diffusion are presented for the beta Si3N4 specimens. Author (ESA)

N81-20284# European Space Agency, Paris (France).

DEGRADATION OF THE SURFACE FINISH OF THE SPACELAB PALLET AFTER ULTRAVIOLET IRRADIATION

J. Bosma (ESTEC, Noordwijk, Netherlands) Dec. 1980 37 p refs Original contains color illustrations

(ESA-STM-215; ISSN-0379-4075) Avail: NTIS HC A03/MF A01

Samples of Chemglaze II A276 on plain and anodized aluminum plates were exposed in a vacuum chamber to 300 and 600 equivalent Sun hours UV exposure at 25 and 80 C. The tests were used to determine the effects of reduced stability under ultraviolet irradiation on the frequency of pallet refurbishment. The temperature of the SPACELAB pallet is an important parameter in determining the ultraviolet degradation of the paint. UV irradiation of the samples at 80 C shows an increase in degradation of solar obsorptance by a factor of two over room temperature measurements. The solar absorptance values measured after degradation are almost identical for the three point compositions tested. Apparently, the advantage gained by applying a thicker layer of point as a means of achieving a low initial solar absorptance is nullified by the increased degradation due to the greater thickness of point. Chemglaze A276 can be refurbished by removal of degraded layers followed by repointing. The ultraviolet stability of the refurbished areas is similar to that of the original point surface. Author (ESA)

N81-20285# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).

CONFERENCE ON THE USE OF POLYMERS [COMPTE-RENDU DE LA TABLE RONDE: UTILISATION DES POLYMERS]

P. Souleille 1980 41 p refs In FRENCH Presented at Centre d'Etude des Rayonnements Journees d'Etudes Sci. et Tech., Toulouse, 16-20 Jun. 1980

Avail: NTIS HC A03/MF A01

The use of polymer coatings and glue is discussed. The mechanical characteristics of various commercially available bonding agents are reported on. The influences of bonding technique, application of primers, surface finishing, and temperature as well as relative humidity on bond strength are also considered. Various coatings and varnishes, specifically in electrical applications, are then discussed. Spreadability, temperature stability, reactivity, and dielectric properties are brought out and compared. High voltage applications are particularly studied. Author (ESA)

N81-20286# California State Dept. of Transportation, Sacramento. Office of Transportation Lab.

FORMULATION AND EVALUATION OF NEW ADHESIVES FOR HIGHWAY USE Final Report, 1977 - 1980

D. R. Chatto and T. L. Shelly Jun. 1980 108 p refs (Contract DOT-FH-D-5-15)

(PB81-129835; TL-635150; FHWA/CA/TL-80-20) Avail: NTIS HC A06/MF A01 CSCL 11A

Epoxy systems were developed and specifications revised to meet today's changing technology along with environmental and health standards. These changes were implemented with updated state specifications. The subjects covered include structural adhesive development related to rapid set epoxy mortar, loop detector sealants, and urethane adhesives, formula component replacement such as asbestos and butyl glycidyl ether; consistency of physical properties; pavement marker adhesive development; accelerated epoxy aging tests; and commercially available adhesives. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N81-20287 Virginia Univ., Charlottesville.
IMPROVEMENTS IN THE ELECTROLYTIC GENERATION OF HYDROGEN Ph.D. Thesis
Patrick Joseph Moran 1980 142 p
Avail: Univ. Microfilms Order No. 8101054

The hydrogen economy is a scheme proposed to alleviate many of the problems of energy transition by the utilization of hydrogen as a synthetic fuel. An attractive method for the production of hydrogen is electrolysis of aqueous potassium hydroxide liberating both hydrogen and oxygen gases. The future utilization of hydrogen producing electrolyzers depends on two main factors. The first of these involves capital investment, particularly when small gas volumes are required. A new electrolyzer was designed and fabricated and is discussed in detail. The second factor influencing the future of electrolytic generation is energy efficiency, especially when considering large scale production. Two areas were researched in connection with efficiency. The first of these involves the investigation of polycrystalline nickel whisker electrodes. Mechanical stability was proven and electrochemical performance on a geometric surface area basis demonstrated encouraging results. The final area concerned with efficiency involves time dependent increases in cell voltage which represent continual decreases in efficiency. It was demonstrated that hydrogen absorption at nickel cathodes is one mechanism responsible for the voltage-time variation.
Dissert. Abstr.

N81-20288# Hazards Research Corp., Rockaway, N.J.
EXPLOSIBILITY OF ENERGETIC MATERIAL DUSTS Final Report
George Patino, Jr., J. W. Gehring, G. J. Friesenhahn, W. T. Moore, P. Lu, S. Roorda, B. Fishburn, and N. Slagg Dover, N.J. Army Armament Research and Development Command Jan. 1981 168 p refs Prepared in cooperation with Southwest Research Inst., San Antonio, Tex. and Army Armament Research and Development Command, Dover, N.J.
(Contract DAAK10-77-C-0086)
(AD-A095353; AD-E400542; ARLCD-CR-80042) Avail: NTIS HC A08/MF A01 CSCL 19/1

To study the problem of dust explosion in the manufacture of explosives and propellants, a program was initiated by ARRADCOM as part of the U.S. Army Modernization and Expansion Plan. This program was performed in three phases, each of which was performed by different contractors. Hazard Research Corporation performed an experimental program to investigate the effects of particle size, dust cloud concentration, and relative humidity on the minimum concentration for explosion, minimum ignition energy and minimum ignition temperature of M-1 and M-30 propellant and explosives. Southwest Research Institute determined the explosibility of M-1 propellant dust as follows: (1) the minimum energy of electrostatic discharge, (2) the minimum explosive dust concentration and (3) the effects of moisture, solvent, temperature, and particle sizes. The Energetics Materials Division, LCWSL, ARRADCOM collected dust samples from representative sites along explosive and propellant production lines at several Army Ammunition Plants and determined whether dust hazards existed. Dynamic flow characteristics for various dust concentrations were established. GRA

N81-20289*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
VISCOELASTIC PROPELLANT EFFECTS ON SPACE SHUTTLE DYNAMICS
Frank Bugg Mar. 1981 22 p refs
(NASA-TM-82403) Avail: NTIS HC A02/MF A01 CSCL 21I

The program of solid propellant research performed in support of the space shuttle dynamics modeling effort is described. Stiffness, damping, and compressibility of the propellant and the effects of many variables on these properties are discussed. The relationship between the propellant and solid rocket booster dynamics during liftoff and boost flight conditions and the effects of booster vibration and propellant stiffness on free free solid rocket booster modes are described. Coupled modes of the shuttle system and th3 effect of propellant stiffness on the interfaces of the booster and the external tank are described. A finite shell model of the solid rocket booster was developed. J.D.H.

N81-20290# Logistics Management Inst., Washington, D. C.
THE DEVELOPMENT OF SYNTHETIC FUELS: DEPARTMENT OF DEFENSE LOGISTICS IMPLICATIONS Final Report
Connelly D. Stevenson Nov. 1980 35 p
(Contract MDA903-77-C-0370)
(AD-A095713; LMI-ML010) Avail: NTIS HC A03/MF A01 CSCL 21/4

The Department of Defense (DoD) has been testing synthetic fuels, especially shale oil, since 1970. The DoD regards synthetic fuels as potential alternative liquid hydrocarbon energy source, especially for mobility applications. The Energy Security Act (ESA) requires the DoD to consume a substantial portion of the initial output of synthetic fuels in order to provide a guaranteed market for the new industry. It is impossible to predict the synthetic fuel production rate growth. The DoD should make incremental flexible projections of synthetic fuel use rates, both for testing and for operational applications, in order to carry out its ESA responsibilities and simultaneously to exploit the synthetic fuels potential. GRA

N81-20291# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
SAFETY AND CHARACTERIZATION TESTS ON HIVELITE COMPOSITION 300435
Louis Avrami Feb. 1981 48 p refs
(Contract AFOSR MIPR N60921-79)
(AD-A095352; AD-E400553; ARLCD-TR-80058) Avail: NTIS HC A04/MF A01 CSCL 19/1

A series of safety and characterization tests were performed on HIVELITE 300435 composition (Teledyne McCormick Selph product) in order to provide sufficient data so that a judgment can be made to qualify the material for in-service use. The tests conducted were impact sensitivity, electrostatic sensitivity, friction sensitivity, vacuum thermal stability, TDA/TGA, explosion temperature test, loading density determinations, coefficient of thermal expansion, growth and exudation, effect of moisture, and burn rate measurements. Comparisons were made with appropriate data generated by Lawrence Livermore Laboratory (LLL) and Teledyne McCormick Selph. The impact tests indicate that HIVELITE 300435 is less sensitive than RDX and just slightly more sensitive than tetryl. HIVELITE 300435 is very sensitive to friction and electrostatic stimuli. Proper precautions should be taken. Burning rate measurements ranged from 283 to 1000 m/s. HIVELITE 300435 0.76 cm in diameter did not detonate with a heavy confinement. GRA

N81-20292# Utah Univ., Salt Lake City. Dept. of Mining and Fuels Engineering.
APPLIED RESEARCH AND EVALUATION OF PROCESS CONCEPTS FOR LIQUEFACTION AND GASIFICATION OF WESTERN COALS Final Report, 1 Jun. 1975 - 31 Jul. 1980
W. H. Wiser Sep. 1980 311 p refs
(Contracts DE-AC01-76ET-10527; E(49-18)-2006)
(DOE/ET-10527/T1) Avail: NTIS HC A14/MF A01

An attempt was made to conduct the process of converting coal to methane at temperatures below 500 C in a single reactor. The various parameters and factors are investigated, including commercially available catalysts, which might make such a process possible. The results from the single stage gasification process with nickel-moly on alumina as a catalyst, a reactor temperature of 500 C, and a hydrogen pressure of 1000 psi are: gases 41.3%, liquids 39.4%, and char 19.3%. The overall conversion of liquids and gases is comparable to the conversion in two stages; however, the liquid yields are higher in the single stage process and yields of ethane are slightly higher than the yields of methane. R.C.T.

N81-20293# Computer Sciences Corp., Washington, D.C.
OFFICE OF ALCOHOL FUELS PROGRAM PLAN, FY 1981
Oct. 1980 122 p
(Contract DE-AC01-79CR-10001)
(DOE/AF-10001/T2) Avail: NTIS HC A06/MF A01

The goal of the Office of Alcohol Fuels is to promote the production, distribution, and use of alcohol fuels. The program objectives are defined and the strategy for implementation is described. An organizational model of the operation is included. The roles of the 3 program offices and various field offices are described. DOE

N81-20294# Tennessee Univ., Knoxville. Dept. of Civil Engineering.
PRODUCTION OF AMMONIA IN A PACKED-BED ANAEROBIC UPFLOW (ANFLOW) BIOREACTOR
D. C. M. Hines, D. W. Weeter, and R. K. Genung 1980 24 p refs Presented at the 73rd Ann. Meeting of the Am. Inst. of Chem. Engr., Chicago, 19 Nov. 1980 Prepared in cooperation with Oak Ridge National Lab., Tenn.
(Contract W-7405-eng-26)
(CONF-801104-10) Avail: NTIS HC A02/MF A01

Anaerobic upflow (ANFLOW) bioreactors which use fixed films of microorganisms were considered for alternative wastewater treatment systems. The advantages of this system are presented. The presence of ammonia in the effluent results in a high nitrogenous oxygen demand to receiving waters and is toxic to certain biota at low concentrations. The presence of ammonia in the effluents of wastewater treatment systems must be regulated. Effluent ammonia and ammonia production rates were monitored within the ANFLOW bioreactor as synthetic feed compositions and flow rates were varied. Correlations between influence organic nitrogen loadings and effluent ammonia concentrations were sought. Subsequent ammonia removal methods were proposed. It was demonstrated that ammonia can be easily nitrified with an aerobic upflow biological filter with only 5% of the volume of the ANFLOW bioreactor. Methane production was also measured. DOE

N81-20295# Delaware Univ., Newark. Dept. of Chemical Engineering.
DEVELOPMENT OF UNIQUE CATALYSTS FOR HYDRODENITROGENATION OF COAL-DERIVED LIQUIDS Annual Report, 15 Sep. 1978 - 14 Sep. 1979
James R. Katzer, Alvin B. Stiles, and Harold Kwart 1 Oct. 1980 195 p refs
(Contracts DE-AS22-78ET-03297; ET-78-C-01-3297)
(DOE/ET-03297/1) Avail: NTIS HC A09/MF A01

Preliminary results from decahydroquinoline hydrodenitrogenation runs show that Bronsted acidity by itself does not catalyze carbon-nitrogen bond scission. The C-N bond clevage must therefore be catalyzed by an active site, which consists of a transition metal ion in close proximity to an acid site. It appears that hydrodenitrogenation requires both an acidic and a basic site for the Hoffman E2 elimination reaction to occur. Several catalysts were prepared and tested, including Bronsted and Lewis acid catalysts without metal, and silica-alumina and gamma-alumina impregnated with molybdenum, vanadium, nickel, or iron. Results show that the nitrogen removal rate was highest for molybdenum on gamma-alumina catalyst and the rate decreased with lower Mo concentrations. Aluminum borate and aluminum borate phosphate catalysts (with or without nickel) were prepared to develop novel catalysts that would selectively coordinate the nitrogen atom and remove it without excessive hydrogenation. DOE

N81-20296# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
MOLTEN SALT COAL GASIFICATION PROCESS DEVELOPMENT UNIT, PHASE 1. VOLUME 1: PDU OPERATIONS Final Report
A. L. Kohl May 1980 244 p
(Contract DE-AC03-77ET-10296)
(DOE/ET-10296/66-VOL-1) Avail: NTIS HC A11/MF A01

Five extended test runs were made. The observed product gas composition was quite close to that predicted on the basis of earlier small scale tests and thermodynamic considerations. All plant systems were operated in an integrated manner during one of the runs. The principal problem encountered during the five test runs was maintaining a continuous flow of melt from the gasifier to the quench tank. Test data and discussions regarding plant equipment and process performance are presented. The program also included a commercial plant study which showed the process to be attractive for use in a combined cycle, electric power plant. DOE

N81-20297# Department of Energy, Washington, D. C. Div. of Fossil Fuel Processing.
COAL CONVERSION 1979 TECHNICAL REPORT
Sep. 1980 179 p refs
(DOE/FE-0010) Avail: NTIS HC A09/MF A01

Individual reports are made on research programs which are being conducted by various organizations and institutions for the commercial development of processes for converting coal into products that substitute for those derived from oil and natural gas. Gasification, liquefaction, and demonstration processes and plants are covered. DOE

N81-20298# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
STOICHIOMETRY OF WOOD LIQUEFACTION
H. G. Davis Oct. 1980 13 p refs
(Contract W-7405-eng-48)
(LBL-11776) Avail: NTIS HC A02/MF A01

It is concluded that the true total yield of nongaseous product (oil + water solubles + char) is higher than was measured, probably as high as 52 to 55% of dry wood feed. Wood decomposes to give water and carbon dioxide, and carbon monoxide in the gas feed reacts with water to give carbon dioxide and hydrogen. However, there is a substantial net reaction of synthesis gas (CO + H2) during the process. This indicates that the reaction CO + (wood product) = CO2 + (reduced wood product) is important in formation of low oxygen product oil. Overall stoichiometry (approximate) is: 100 lbs wood + 0.5 Mol CO yields 1.1 Mol CO2 + 0.5 Mol H2O + 55 bls nonvapor product. Consumption of synthesis gas in the process is (very approximately) 1300 SCF/bbl product. The product oil has a hydrogen/carbon atom ratio of 1.2 and is highly aromatic. This analysis of the reaction applies specifically to the so called PERC process with a very high recycle of product oil. DOE

N81-20299# Commission of the European Communities, Luxembourg.
IMPROVEMENT OF THE ELECTROLYTIC PROCESS OF HYDROGEN PRODUCTION Final Report
1980 83 p In FRENCH; ENGLISH summary
(EUR-6764-FR) Avail: NTIS HC A05/MF A01

Testing of electrodes and membranes was performed both separately and in a complete electrolysis apparatus. This complete electrolysis apparatus consists of a battery of six electrolyzers with 4 x 15 sq cm electrodes and electrolyte flows and pressurization (4 atm). Main results are a total cell voltage around 1.8 to 1.9 V at 10 kA m/2 120 C 1 to 4 atm, under flow conditions and after aging (1200 h). High temperature sintered electrodes show good erosion resistance, but diaphragms need external reinforcement not to be eroded. Temperature, pressure and electrolyte flow speed effects were thoroughly examined in order to determine optimal working conditions of the electrolyzers. DOE

N81-20300# Brookhaven National Lab., Upton, N. Y.
REVIEW OF FUSION SYNFUELS
J. A. Fillo 1980 14 p refs Presented at the 4th ANS Topical Meeting on the Technol. of Controlled Nucl. Fusion, King of Prussia, Pa., 14-17 Oct. 1980
(Contract DE-AC02-76CH-00016)
(BNL-28627; CONF-801011-74) Avail: NTIS HC A02/MF A01

Thermonuclear fusion offers an inexhaustible source of energy for the production of hydrogen from water. Depending on design, electric generation efficiencies of about 40 to 60% and hydrogen production efficiencies by high temperature electrolysis of about 50 to 65% are projected for fusion reactors using high temperature blankets. Fusion/coal symbiotic systems appear economically promising for the first generation of commercial fusion synfuels

plants. Coal production requirements and the environmental effects of large scale coal usage would be greatly reduced by a fusion/coal system. In the long term, there could be a gradual transition to an inexhaustible energy system based solely on fusion. DOE

N81-20301# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.

FLASH PYROLYSIS AND HYDROPYROLYSIS OF COAL

Meyer Steinberg and Bharat Bhatt Oct. 1980 22 p refs Presented at the Specialist Workshop on Fast Pyrolysis of Biomass, Copper Mountain, Colo., 20 Oct. 1980

(Contract DE-AC02-76CH-00016)

(BNL-28577; CONF-8010126-1) Avail: NTIS HC A02/MF A01

Rapid pyrolysis of coal usually produces larger yields of volatile matter including liquid and gaseous hydrocarbons than slow pyrolysis. Rapid pyrolysis in vacuum or with an inert atmosphere yields lower conversions of coal to liquid and gaseous hydrocarbons than hydropyrolysis in a hydrogen atmosphere. Pyrolysis in a higher pressure inert atmosphere tends to decrease overall yields. Rapid pyrolysis in an inert atmosphere produces larger amounts of heavier liquids and tars than hydropyrolysis. Hydropyrolysis at higher hydrogen pressures produces higher overall yields. Rapid pyrolysis at higher temperatures tends to decrease yields and produce lower molecular weight species. Rapid hydropyrolysis at higher temperatures produces more gaseous hydrocarbons and lower liquid yields. There are optimum residence times for maximizing either liquid or gaseous yields. Pyrolysis in an inert atmosphere at longer residence times tend to increase coversions but then becomes constant after devolatilization is complete. DOE

N81-20302# Bechtel National, Inc., San Francisco, Calif.

COAL PREPARATION USING MAGNETIC SEPARATION. VOLUME 5: EVALUATION OF MAGNETIC COAL DESULFURIZATION CONCEPTS Final Report

F. V. Karlson, H. Huettenhain, M. Epstein, O. N. Degiovanni, and P. J. Chassagne Jul. 1980 187 p refs

(EPRI Proj. 980-5)

(EPRI-CS-1517-Vol-5) Avail: NTIS HC A09/MF A01

Magnetic separator designs performed by four contractions were reviewed. A complete plant conceptual design was developed, based on high gradient magnetic separator (HGMS) designs proposed by Sala Magnetics, Inc., and the Magnetic Corporation of America (MCA). A design for a conventional heavy medium plant was also developed and costed to establish a point of comparison for the HGMS designs. The HGMS design provided by Sala is based on their commercial operating experience in the iron ore concentration industry and operation of a one ton/hour continuous pilot plant, while the superconducting HGMS proposed by MCA represents a conceptual design based on bench scale data. The three plants were designed to clean 2.64 million tons/year of feed and produce approximately 2.2 million tons/year of clean coal. Also, a technical review of the Magnex process as developed by Nedlog Technology Group/Hazen Research, Inc., was performed. DOE

N81-20303# Los Alamos Scientific Lab., N. Mex.

NUMERICAL CALCULATION OF SHOCK-INDUCED INITIATION OF DETONATIONS

G. Edward Cort and Jerry H. Fu 1980 19 p refs Presented at the JANNAF Intragency Propulsion Comm., 1980 Propulsion Systems Hazards Meeting, Monterey, Calif., 27-31 Oct., 1980

(Contract W-7405-eng-36)

(LA-UR-80-2854; CONF-8010121-1) Avail: NTIS HC A02/MF A01

The results of some numerical calculations of the impact of steel cylinders and spheres on the plastic bonded high explosive PBX 9501 are described. The calculations were carried out by a reactive, multicomponent, two dimensional, Eulerian hydrodynamic computer code, 2DE computer code is a finite difference code that uses the donor acceptor cell method to compute mixed cell fluxes. The mechanism of shock initiation to detonation in heterogeneous explosives is best described as local decomposition at hot spots that are formed by shock interactions with density discontinuities. The liberated energy strengthens the shock so that as it interacts with additional inhomogeneities, hotter hot spots are formed, and more of the explosive is decomposed. The shock wave grows stronger until a detonation begins. This mechanism of initiation was described numerically by the Forest Fire burn model, which gives the rate of explosive decomposition as a function of local pressure. DOE

N81-20304# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.

COAL HYDROGASIFICATION PROCESS DEVELOPMENT Quarterly Technical Progress Report, 1 Oct. - 31 Dec. 1980

L. P. Combs, L. S. Breese, D. R. Kahn, M. D. Schuman, C. W. Adamson, and W. T. Lee Jan. 1981 41 p refs

(Contracts DE-AC01-78ET-10328; ET-78-C-01-3125)

(DOE/ET-10328/27) Avail: NTIS HC A03/MF A01

A program schedule delineating the breakdown of the overall program into tasks and logical subtasks and time-phased relationships among them is shown. The major tasks are summarized. Task I is concerned with the engineering-scale testing. Task II is concerned with design, construction, and testing. Task III provides for process optimization studies and for preliminary design of a commerical plant. DOE

N81-20305# Oak Ridge National Lab., Tenn. Environmental Sciences Div.

ENVIRONMETRICS OF SYNFUELS. 1: PROCESSING THE AUTOMATED PDP-11 DATA COMPONENTS FOR THE UMD GASIFIER FACILITY

R. H. Strand, M. P. Farrell, C. W. Gudmundson (Union Carbide Corp.), T. K. Birchfield (Union Carbide Corp.), S. S. Casada (Union Carbide Corp.), and M. E. Vansuch (Union Carbide Corp.) Jan. 1981 34 p

(Contract W-7405-eng-26)

(ORNL/TM-7428) Avail: NTIS HC A03/MF A01

This report summarizes the techniques and procedures used to handle automated data collected at the University of Minnesota-Duluth (UMD) campus coal gasification facility. This facility, which is partially funded by the Department of Energy, is being evaluated by scientists at Oak Ridge National Laboratory (ORNL) for its potential health and environmental effects. Automatic data collections and manually collected and sample results data are used for this assessment. A data management project at ORNL handles these and other UMD data for the Gasifiers in Industry Program. The procedures developed within the data management project for handling two categories of automated data are documented. The examples use actual data from the first one and a half years of gasifier operation. DOE

N81-20306# Arizona State Univ., Tempe. Coll. of Engineering and Applied Sciences.

CONVERSION OF CELLULOSIC WASTES TO LIQUID FUELS Interim Report

J. L. Kuester Sep. 1980 74 p refs

(Contracts DE-AS02-76CS-40202; EY-76-S-02-2982)

(COO-2982-57) Avail: NTIS HC A04/MF A01

A project to convert waste cellulosic (biomass) materials to quality liquid hydrocarbon fuels is described. The basic approach is indirect liquefaction, i.e., thermal gasification followed by catalytic liquefaction. The indirect approach results in separation of the oxygen in the biomass feedstock, i.e., oxygenated compounds do not appear in the liquid hydrocarbon fuel product. The process is capable of accepting a wide variety of feedstocks. Potential products include medium quality gas, normal propanol, diesel fuel and/or high octane gasoline. A fluidized bed pyrolysis system is used for gasification. The pyrolyzer can be fluidized with recycle pyrolysis gas, steam or recycle liquefaction system of gas or some combination thereof. The tasks specified were: (1) feedstock studies; (2) gasification system optimization; (3) waste stream characterization; and (4) liquid fuels synthesis. DOE

N81-20307# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. Quality Div.

ANALYSIS OF RDX AND HMX IN PBX 9404 BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY

Benny R. Richardson Nov. 1980 11 p

(Contract DE-AC04-76DP-00487)

(MHSMP-80-55) Avail: NTIS HC A02/MF A01

An analysis for the HMX and RDX contents of PBX 9404 was developed. Instrumental parameters, such as column type,

solvent, flow rate, and method of detection are discussed. The calibration method is examined and precision and accuracy investigated. The average recovery of HMX is 98.7 percent with a standard deviation of 0.82 percent; for RDX, the percent recovery is 98.66 percent with a standard deviation of 0.27 percent.
DOE

N81-20308# Washington State Univ., Pullman. Nuclear Radiation Center.
SOLVENT REFINED COAL (SRC) PROCESS: TRACE ELEMENTS RESEARCH AND DEVELOPMENT. VOLUME 3: PILOT PLANT DEVELOPMENT WORK. PART 6: THE FATE OF TRACE ELEMENTS IN THE SRC PROCESS Interim Report, 1 Aug. 1977 - 28 Feb. 1979
R. H. Filby, S. R. Khalil, C. A. Grimm, V. Ekabaram, and M. L. Hunt Dec. 1980 169 p refs Prepared for Pittsburg and Midway Coal Mining Co., Englewood, Colo.
(Contract DE-AC01-76ET-10104)
(DOE/ET-10104/T11; Rept-53; IR-34) Avail: NTIS HC A08/MF A01

The results of neutron activation analysis determination of the fate of trace elements in the SRC 2 process are reported. Six coals were studied for their behavior in material balance runs carried out at the Fort Lewis Pilot Plant. The distribution of trace elements among products and input streams was determined by thermal neutron activation analysis using thermal neutron flux of 8 x 10 to the 12th power neutrons/(sq cm) (sec) followed by Ge(Li) gamma ray spectroscopy. National Bureau of Standards Standard Reference Materials (SRM) were used to evaluate the analytical precision and accuracy of the methods used. For each material balance study, the trace element input stream was taken as ground coal and the output streams were vacuum bottoms, SRC 2 product oil, and process water. In addition to these major components, oils, sludges, and waters from liquid-liquid separators, effluent waters, biosludges, and by-product sulfur were also analyzed. Concerning the distribution of trace elements in the SRC 2 process, it was found that the vacuum bottoms were the major sinks for all trace element studied, with the exception of Hg. DOE

N81-20309# Fulmer Research Inst. Ltd., Stoke Poges (England).
STUDY ON ADDITIONAL PROPELLANTS FOR FIELD EMISSION THRUSTERS Final Report
D. Stewart, P. D. Wilson, and M. G. Nicholas (Atomic Energy Research Establishment) Paris ESA Jun. 1980 85 p refs
(Contract ESTEC-3806/78/NI-JS(SC))
(FRI-R664; ESA-CR(P)-1395) Avail: NTIS HC A05/MF A01

Candidate metals or alloys to replace cesium as a field emission thruster propellant were selected in a literature search and tested. The criteria used to select the alternative propellants are a low electrical resistivity/thermal conductivity ratio, low melting point and high atomic mass. Other criteria considered include vapor pressure, toxicity, beam efficiency, cost, wetting characteristics and possible interaction with materials used in the manufacture of the thruster. The important parameters of the propellants selected compared with Cs are given. Experimental evaluation of the wetting properties of these propellants was made on substrates of Ti, W, Mo, W alloy and stainless steel.
Author (ESA)

N81-20310# Centre National d'Etudes Spatiales, Toulouse (France). Dept. Stabilization-Systemes.
EVALUATION OF A PYROTECHNIC ACTUATOR CONCEPT BY MEANS OF THE PROBIT STATISTICAL METHOD. JUSTIFICATION OF THE CHOICE OF THIS METHOD; APPLICATION; EXAMPLES OF APPLICATION
C. Tarrieu 15 Mar. 1978 50 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-694)
(CNES-78/CT/PRT/SST/SE/72) Avail: NTIS HC A03/MF A01

An aging model and ignition tests which are evaluated using the probits method are considered. Results show that experimental reliability of pyrotechnic valves, a cable cutter, or any other pyromechanism can be determined to within a 90% confidence limit, given a minimum sampling of 25 units. Author (ESA)

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N81-20311*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ANALYSIS AND SIMULATION OF A MAGNETIC BEARING SUSPENSION SYSTEM FOR A LABORATORY MODEL ANNULAR MOMENTUM CONTROL DEVICE
Nelson J. Groom, Charles T. Woolley, and Suresh M. Joshi (Vigyan Research Associates, Inc.) Mar. 1981 38 p refs
(NASA-TP-1799; L-12403) Avail: NTIS HC A03/MF A01 CSCL 14B

A linear analysis and the results of a nonlinear simulation of a magnetic bearing suspension system which uses permanent magnet flux biasing are presented. The magnetic bearing suspension is part of a 4068 N-m-s (3000 lb-ft-sec) laboratory model annular momentum control device (AMCD). The simulation includes rigid body rim dynamics, linear and nonlinear axial actuators, linear radial actuators, axial and radial rim warp, and power supply and power driver current limits. Author

N81-20312*# Textron Bell Helicopter, Fort Worth, Tex.
DEVELOPMENT AND VALIDATION OF CRYOGENIC FOAM INSULATION FOR LH2 SUBSONIC TRANSPORTS Final Report
F. M. Anthony, J. Z. Colt, and R. G. Helenbrook Washington NASA Feb. 1981 79 p refs
(Contract NAS1-10969)
(NASA-CR-3404; Rept-8654-927001) Avail: NTIS HC A05/MF A01 CSCL 11G

Fourteen foam insulation specimens were tested. Some were plain foam while others contained flame retardants, chopped fiberglass reinforcement and/or vapor barriers. The thermal performance of the insulation was determined by measuring the rate at which LH2 boiled from an aluminum tank insulated with the test material. The test specimens were approximately 50 mm (2 in.) thick. They were structurally scaled so that the test cycle would duplicate the maximum thermal stresses predicted for the thicker insulation of an aircraft liquid hydrogen fuel tank during a typical subsonic flight. The simulated flight cycle of approximately 10 minutes duration heated the other insulation surface to 316 K (110 F) and cooled it to 226 K (20 F) while the inner insulation surface remained at liquid hydrogen temperature of 20 K (-423 F). Two urethane foam insulations exceeded the initial life goal of 2400 simulated flight cycles and sustained 4400 cycles with only minor damage. The addition of fiberglass reinforcement of flame retardant materials to an insulation degraded thermal performance and/or the life of the foam material. Installation of vapor barriers enhanced the structural integrity of the material but did not improve thermal performance. All of the foams tested were available materials; none were developed specifically for LH2 service. Author

N81-20313# Centre National d'Etudes Spatiales, Toulouse (France). Div. Stabilisation-Structures-Thermique.
CATALOG OF FRENCH COLD GAS EQUIPMENT FOR USE IN SPACE APPLICATIONS
R. Salome 6 Dec. 1979 48 p In FRENCH; ENGLISH summary
(CNES-CT/PRT/SST/SE/349) Avail: NTIS HC A03/MF A01

As an aid in the development and design of satellites and spaceborne experiments, a catalog of cryogenic equipment is provided. Standard technical data sheets are given for each item listed. Equipment covered mainly consists of high pressure tanks, regulators, and pyrotechnic as well as electromagnetic valves. All materials listed were developed and qualified under European contracts. Author (ESA)

N81-20314# Zinc Alloy Die Casting Society, New Delhi (India).
DIE CASTING
Nov. 1980 25 p refs
(PB81-123697; Rept-28) Avail: NTIS HC A02/MF A01 CSCL 13H

Contents include: Indian diecasting industry, its problems and prospects; push-button locks; 9th International Diecasting

conference and 8th exhibition; seminar on gating of diecasting dies and diecasting technology; and the 6th student industrial design competition--Uk. New publications and abstracts are presented. GRA

N81-20315# Northeast-Midwest Inst., Washington, D.C.
WATER RESOURCE PRIORITIES FOR THE MIDWEST
Michael Sullivan and Richard Durkin Sep. 1980 75 p refs
(Grants EDA-99-7-13507; EDA-ERD-699-G-79-33)
(PB81-129801; EDA-ERD-80-169) Avail: NTIS HC A04/MF A01 CSCL 13B

Various water resource priorities are discussed for seven states: Ohio, Indiana, Illinois, Michigan, Minnesota, Wisconsin, and Iowa. These priorities include: water quality, water supply, energy, transportation, flood control and damage reduction, coastal management, and recreation. Policy alternatives to accomplish these priorities are also discussed. GRA

N81-20316# Texas Univ. at Austin. Center for Research in Water Resources.
OPTIMAL RISK-BASED DESIGN OF WATER RESOURCE ENGINEERING PROJECTS Final Report
Yeou-Koung Tung and Larry W. Mays Aug. 1980 420 p refs
(Grant NSF ENG-78-05449)
(PB81-136202; CRWR-171) Avail: NTIS HC A18/MF A01 CSCL 13B

Procedures are presented which systematically analyze the uncertainities involved in both the hydrologic and hydraulic aspects, so that the risk and the reliability of the hydraulic structure can be evaluated. A general framework for evaluating the risk and reliability of hydraulic structures is developed which takes into account the uncertain features involved in both the hydrologic and hydraulic aspects. First order analysis of uncertainty is used for analyzing the hydraulic uncertainty in which the capacity of a hydraulic structure is expressed as the function of several variables with uncertainty. The incorporation of uncertainty analysis into an optimization framework to obtain an optimal risk based design is made. Examples for the culvert design and flood levee design are presented. GRA

N81-20317# Swedish Council for Building Research, Stockholm.
OPTIMAL DISTRIBUTION OF THERMAL INSULATION AND GROUND HEAT LOSSES
Johan Claesson and Bengt Eftring 1980 98 p
(PB81-122871; ISBN-91-540-3321-7; D33-1980) Avail: NTIS HC A05/MF A01 CSCL 13M

The basic criterion for insulating a building against the surrounding ground is that the heat flux across the insulation must be constant along the surface of the insulation. A numerical theory for optimizing the distribution of thermal insulation is presented and applied to the following cases: a rectangular plate on the ground; a circular disk on the ground; a cellar (parallelepipedic shape); a rectangular cellar cross section (two dimensional case); and a cylindrical cellar (heat storage). The optimal distribution is also given for a culvert of rectangular cross section for different heights, widths, and depths below the surface. The thickness factor is considered in all cases. A.R.H.

N81-20318# National Bureau of Standards, Washington, D.C. Center for Building Technology.
A REFERENCE BUILDING APPROACH TO BUILDING ENERGY PERFORMANCE STANDARDS FOR SINGLE-FAMILY RESIDENCES Final Report
Stephen R. Petersen and Jim L. Heldenbrand Oct. 1980 40 p refs
(Contract EA-77-A-01-6010)
(PB81-135642; NBSIR-80-2161) Avail: NTIS HC A03/MF A01 CSCL 13A

A reference building approach to building energy performance standards is described. Each proposed building design would be compared with a reference building design and operating profile. In order to comply with the standard, the design energy requirements of the new building would not be allowed to exceed those of the reference building when evaluated by a parallel modeling process. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N81-20319 Syracuse Univ., N. Y.
EXTENSION OF VOLTERRA ANALYSIS TO WEAKLY NONLINEAR ELECTROMAGNETIC FIELD PROBLEMS WITH APPLICATION TO WHISTLER PROPAGATION Ph.D. Thesis
Donald Charles Dalpe 1980 208 p
Avail: Univ. Microfilms Order No. 8104517

Generalized Green's functions and their Fourier transforms are introduced and used to express the nth order system response explicitly in terms of the system input. Although the theory is developed in general, homogeneous media are assumed in the examples for simplicity. Generation of the required generalized Green's functions is discussed. Application of the Volterra approach is illustrated by investigating whistler mode propagation in a cold collisionless electron plasma. After developing the nonlinear differential equations for propagation at an angle to the uniform magnetic field, exponential inputs are used to generate the generalized Green's functions. The second order responses, which are expressed in terms of the generalized Green's functions, are examined in detail. Computer programs are used to numerically evaluate the second order response to a sinusoidally varying time function. Dissert. Abstr.

N81-20320 Cornell Univ., Ithaca, N. Y.
SHORT TRANSIT TIME PHOTOCONDUCTIVE DETECTORS FOR HIGH SPEED OPTICAL COMMUNICATION Ph.D. Thesis
John Christopher Gammel 1980 230 p
Avail: Univ. Microfilms Order No. 8102910

Several types of high speed photoconductive detectors are discussed. These detectors are shown to have good potential as wide bandwidth (multi-HGz bandwidth) detectors for optical communications. Measurements and calculations are made for two device structures; the first is similar to the GaAs MESFET and is compatible with an optical waveguide for integrated optics applications; the second has a larger active area and is compatible with fiber optics applications. The gain of these detectors depends on the ratio of hole transit time to electron transit time across the photoconductor. These are the first practical photoconductors to take advantage of the large ratio of electron velocity to hole velocity typical of many group 3 to group 5 compounds. The gain bandwidth product of any photoconductor depends on the inverse of the carrier transit time. The photoconductive detectors are the first to fully utilize the short transit time structures made possible by current semiconductor technology. Dissert. Abstr.

N81-20321 Iowa State Univ. of Science and Technology, Ames.
STABILITY OF VLF GROUP VELOCITY OVER LONG RANGES Ph.D. Thesis
Thomas Joseph Essenmacher 1980 160 p
Avail: Univ. Microfilms Order No. 8106008

The stability of the group delay of very low frequency signals over transmission paths from Hawaii and Argentina to Ames, Iowa, was investigated. A method for obtaining optimal phase measurements by using Fourier series techniques was developed. Comparisons of the optimal phase measurement technique with a commonly used technique showed advantages of the Fourier series method of phase determination. The approximate group delay was computed by using phase delay measurements of two closely spaced signals in the VLF range. A microcomputer was used as a special purpose Fourier analyzer to obtain optimal phase measurements which, in turn, were used to compute group delays. Results indicate that atmospheric noise appears to be the main cause of the short term group delay variation. Dissert. Abstr.

N81-20322# Radio Technical Commission for Aeronautics, Washington, D. C.

MINIMUM OPERATIONAL PERFORMANCE STANDARDS FOR AIRBORNE RADAR APPROACH AND BEACON SYSTEMS FOR HELICOPTERS
19 Nov. 1980 105 p
(RTCA/DO-172; LC-80-60000206) Avail: NTIS MF A01; HC $16.00 from RTCA Secretariat Suite 655, 1717 H Street, N.W., Washington, D.C. 20006

Minimum operational performance standards are presented for airborne radar approach systems based on operational requirements of helicopters in the approach, missed approach, and departure modes, particularly during instrument flight rules, instrument meteorological conditions and at night. Included are those system characteristics pertinent to the airborne equipment and to the ground-based radar beacon for those operations requiring such equipment. Operational goals were established based on future requirements and technology, rather than merely repeating current state-of-the-art criteria. M.G.

N81-20323# Radio Technical Commission for Aeronautics, Washington, D. C.
MINIMUM OPERATIONAL PERFORMANCE STANDARDS FOR AIRBORNE WEATHER AND GROUND MAPPING PULSED RADARS
19 Nov. 1980 79 p Supersedes RTCA/DO-134
(RTCA/DO-173; RTCA/DO-134; LC-80-60000205) Avail: NTIS MF A01; HC $16.00 from RTCA Secretariat, Suite 655, 1717 H Street, N.W., Washington, D.C. 20006

Minimum operational performance standards for airborne weather and ground mapping pulsed radars, including both air carrier and large aircraft-type radar systems, are described. Those requirements and technologies pertinent to general aviation, where limitations on space and/or weight may apply are taken into account. M.G.

N81-20324*# City Univ. of New York, N. Y. Communications Systems Lab.
THE EFFECT OF INTERFERENCE ON DELTA MODULATION ENCODED VIDEO SIGNALS Final Annual Report, 1 Oct. 1978 - 1 Oct. 1979
Donald L. Schilling 1979 18 p refs
(Contract NAS9-13940)
(NASA-CR-160923) Avail: NTIS HC A02/MF A01 CSCL 17B

An adaptive delta modulator which encodes composite color video signals was shown to provide a good response when operating at 16 Mb/s and near-commercial quality at 23Mb/s. The ADM was relatively immune to channel erors. The system design is discussed and circuit diagrams are included. A.R.H.

N81-20325# Communications Research Centre, Ottawa (Ontario). Space Technology and Applications Branch.
SUBJECTIVE EVALUATION OF FM/FM PROTECTION RADIO FOR TELEVISION BROADCASTING BY SATELLITE, APPENDICES
Chun Loo, G. Chouinard (Canadian Broadcasting Corp.), and W. B. Tonner (Canadian Broadcasting Corp.) Dec. 1980 80 p refs
(CRC-1340) Avail: NTIS HC A05/MF A01

Subjective measurements of the interference between two FM TV signals at the same carrier frequency and at different carrier frequencies are described. There is no masking of the interference due to additive Gaussian noise in the wanted channel. The results do not support the conclusion that an impairment grade of 4.5 on the CCIR scale is subjectively equivalent to just perceptible interference. A comparison of results of measurements of the protection ratio and its variation with frequency offset with those obtained by others shows good agreement. S.F.

N81-20326# Communications Research Centre, Ottawa (Ontario). Communications Systems Branch.
RACE: AN AUTOMATIC HIGH FREQUENCY RADIO TELEPHONE SYSTEM FOR COMMUNICATIONS IN REMOTE AREAS
S. M. Chow, G. W. Irvince, and B. McLarnon Dec. 1980 15 p refs
(CRC-1338-E) Avail: NTIS HC A02/MF A01

A high frequency radiotelephone system offering enhanced performance compared to that of existing systems is described. The enhancements include real-time channel evaluation and the capability of interfacing to existing telephone systems without the need for operators. Results of preliminary on-the-air field trials indicate that the system is reliable and exceptionally easy to use. M.G.

N81-20327*# Axiomatix, Los Angeles, Calif.
SHUTTLE ORBITER KU-BAND RADAR/COMMUNICATIONS SYSTEM DESIGN EVALUATION Final Report
J. Dodds, J. Holmes, G. K. Huth, R. Iwasaki, R. Maronde, A. Polydoros, C. Weber, and P. Broad 22 Dec. 1980 372 p refs
(Contract NAS9-15795)
(NASA-CR-160898; R8012-3) Avail: NTIS HC A16/MF A01 CSCL 17B

Tasks performed in an examination and critique of a Ku-band radar communications system for the shuttle orbiter are reported. Topics cover: (1) Ku-band high gain antenna/widebeam horn design evaluation; (2) evaluation of the Ku-band SPA and EA-1 LRU software; (3) system test evaluation; (4) critical design review and development test evaluation; (5) Ku-band bent pipe channel performance evaluation; (6) Ku-band LRU interchangeability analysis; and (7) deliverable test equipment evaluation. Where discrepancies were found, modifications and improvements to the Ku-band system and the associated test procedures are suggested. A.R.H.

N81-20328*# Novar Electronics Corp., Barberton, Ohio.
A THEORETICAL STUDY OF MICROWAVE BEAM ABSORPTION BY A RECTENNA Final Report
James H. Ott, James S. Rice, and Donald C. Thorn 14 Jan. 1981 133 p refs
(Contract NAS9-16055)
(NASA-CR-160921) Avail: NTIS HC A07/MF A01 CSCL 20N

The theoretical operational parameters for the workable satellite power system were examined. The system requirements for efficient transmission and reception of an environmentally benign microwave beam were determined. For individual titles, see N81-20329 through N81-20335.

N81-20329*# Novar Electronics Corp., Barberton, Ohio.
A THEORETICAL STUDY OF MICROWAVE BEAM ABSORPTION BY A RECTENNA, INTRODUCTION
In its A Theoret. Study of Microwave Beam Absorption by a Rectenna 14 Jan. 1981 p 1-36 refs (For primary document see N81-20328 11-32)
Avail: NTIS HC A07/MF A01 CSCL 20N

The conditions required for a large rectenna array (i.e., reference design) to absorb nearly 100% of transmitted energy were studied. Design parameters including element spacing, and the manner in which these affect scatter were formulated. Amplitutes and directions of scatter and development of strategies for mitigation were also investigated. The effects on rectenna behavior of external factors such as weather and aircraft overflights were determined. R.C.T.

N81-20330*# Novar Electronics Corp., Barberton, Ohio.
PLANE WAVE DERIVATION
In its A Theoret. Study of Microwave Beam Absorption by a Rectenna 14 Jan. 1981 p 39-43 (For primary document see N81-20328 11-32)
Avail: NTIS HC A07/MF A01 CSCL 20N

The characteristic of plane waves are derived from Maxwell's equations. The derivation utilizes both the transmission and reflection of plane waves as a basis for its formulation. R.C.T.

N81-20331*# Novar Electronics Corp., Barberton, Ohio.
CURRENT SHEET MODEL
In its A Theoret. Study of Microwave Beam Absorption by a Rectenna 14 Jan. 1981 p 47-56 (For primary document see N81-20328 11-32)
Avail: NTIS HC A07/MF A01 CSCL 20N

The model of a rectenna based on the current sheet equivalency of a large planar array is described. The model is mathematically characterized by expression for the fraction of the incident plane wave that is reflected from the sheet. The

model is conceptually justified for normal incidence by comparing it to the waveguide model in which evanescent modes, present as beyond and cutoff, correspond to the near field components which become negligible at any significant distance from the antenna array. R.C.T.

N81-20332*# Novar Electronics Corp., Barberton, Ohio.
WAVEGUIDE MODEL
In its A Theoret. Study of Microwave Beam Absorption by a Rectenna 14 Jan. 1981 p 59-77 (For primary document see N81-20328 11-32)
Avail: NTIS HC A07/MF A01 CSCL 20N

A model is presented which quantifies the electromagnetic modes (field configurations) in the immediate vicinity of the rectenna element. Specifically, the waveguide model characterizes the electromagnetic modes generated by planar waves normal to the array. The model applies only to incidence normal to the array. R.C.T.

N81-20333*# Novar Electronics Corp., Barberton, Ohio.
GRATING LOBES
In its A Theoret. Study of Microwave Beam Absorption by a Rectenna 14 Jan. 1981 p 81-90 (For primary document see N81-20328 11-32)
Avail: NTIS HC A07/MF A01 CSCL 20N

The radiation patterns characteristic of an indefinite planar array of isotropic antennas was investigated. Particular emphasis was given to the grating lobe scatter from the rectenna. It is shown that an idealy arrayed rectenna of indefinite extent would produce grating lobes which are impulsive. It is further shown that a shift to finite extent or introduction of typical variations in element placement should generate more typical patterns. R.C.T.

N81-20334*# Novar Electronics Corp., Barberton, Ohio.
TOLERENCE AND PERTURBATION ANALYSIS
In its A Theoret. Study of Microwave Beam Absorption by a Rectenna 14 Jan. 1981 p 93-107 (For primary document see N81-20328 11-32)
Avail: NTIS HC A07/MF A01 CSCL 20N

Rectenna deviations are described which produce errors in the since of reduced efficiency and/or scattering. Three classes of deviations are emphasized: random construction variations; systematic variations; and atmospheric induced randomness. R.C.T.

N81-20335*# Novar Electronics Corp., Barberton, Ohio.
TROPOSPHERIC/IONOSPHERIC TRANSMISSION TESTS
In its A Theoret. Study of Microwave Beam Absorption by a Rectenna 14 Jan. 1981 p 111-118 (For primary document see N81-20328 11-32)
Avail: NTIS HC A07/MF A01 CSCL 20N

Four tests are described which are designed to evaluate the magnitude, type, and frequency of occurence of amplitude and phase variations in the solar power satellite power (SPS) beam as seen by the rectenna. Particular attention is given to the degree of deviation in the propagation observed under two conditions unique to the SPS: monochromaticity; and smallness of the effective aperture of individual rectenna element dipoles. R.C.T.

N81-20336*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
'FINITE PART' ELECTRIC AND MAGNETIC STORED ENERGIES FOR PLANAR ANTENNAS
C. R. Cockrell Feb. 1981 29 p refs
(NASA-TM-81955) Avail: NTIS HC A03/MF A01 CSCL 09C

A pair of formulas representing the time-average 'finite part' electric and magnetic stored energies for planar antennas are derived. It is also shown that the asymptotic reciprocal relationship between quality factor and relative bandwidth exists for planar antennas. Author

N81-20337*# General Electric Co., Schenectady, N. Y. Corporate Research and Development.
SATELLITE-AIDED MOBILE COMMUNICATIONS LIMITED OPERATIONAL TEST IN THE TRUCKING INDUSTRY Final Report, Nov. 1977 - Jul. 1980
Roy E. Anderson, Richard L. Frey, and James R. Lewis Jul. 1980 145 p refs
(Contract NAS5-24365)
(NASA-CR-166658; SRD-81-005) Avail: NTIS HC A07/MF A01 CSCL 17B

An experiment with NASA's ATS-6 satellite, that demonstrates the practicality of satellite-aided land mobile communications is described. Satellite communications equipment for the experiment was designed so that it would be no more expensive, when mass produced, than conventional two-way mobile radio equipment. It embodied the operational features and convenience of present day mobile radios. Vehicle antennas 75 cm tall and 2 cm in diameter provided good commercial quality signals to and from trucks and jeeps. Operational applicability and usage data were gathered by installing the radio equipment in five long-haul tractor-trailer trucks and two Air Force search and rescue jeeps. Channel occupancy rates are reported. Air Force personnel found the satellite radio system extremely valuable in their search and rescue mission during maneuvers and actual rescue operations. Propagation data is subjectively analyzed and over 4 hours of random data is categorized and graded as to signal quality on a second by second basis. Trends in different topographic regions are reported. An overall communications reliability of 93% was observed despite low satellite elevation angles ranging from 9 to 24 degrees. M.G.

N81-20338*# General Electric Co., Schenectady, N. Y. Corporate Research and Development.
SATELLITE-AIDED MOBILE RADIO CONCEPTS STUDY: CONCEPT DEFINITION OF A SATELLITE-AIDED MOBILE AND PERSONAL RADIO COMMUNICATION SYSTEM Final Report
R. E. Anderson Jun. 1979 198 p refs
(Contract NAS5-25134)
(NASA-CR-166646) Avail: NTIS HC A09/MF A01 CSCL 17B

The satellite system requires the use of a large satellite antenna and spacecraft array power of about 12 kW or more depending on the operating frequency. Technology developments needed include large offset reflector multibeam antennas, satellite electrical power sybsystems providing greater than 12 kW of power, signal switching hardware, and linearized efficient solid state amplifiers for the satellite-aided mobile band. Presently there is no frequency assignment for this service, and it is recommended that an allocation be pursued. The satellite system appears to be within reasonable extrapolation of the state of the art. It is further recommended that the satellite-aided system spacecraft definition studies and supporting technology development be initiated. Author

N81-20339*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK: AN INSTRUMENT FOR RADIO SCIENCE RESEARCH
N. A. Renzetti 15 Feb. 1981 76 p refs
(Contract NAS7-100)
(NASA-CR-164077; JPL-Pub-80-93) Avail: NTIS HC A05/MF A01 CSCL 17B

Doppler and ranging data routinely generated at the Deep Space Stations of the California Institute of Technology-Jet Propulsion Laboratory Deep Space Network serve as an excellent source of radio science information. Important radio science experiments based on Deep Space Network generated radio metric data have included confirmation of Einstein's Theory of Relativity, measurement of the masses and gravitational harmonics of the planets out to Saturn, and measurement of electron density distribution and turbulence in the solar corona. In response to an increased level of radio science requirements, the Deep Space Network chose in 1976 to implement a new radio science system, which was completed in late 1978. Key features include (1) highly phase stable open loop receivers, (2) reduction of recorded data bandwidth through use of programmed local oscillators, and (3) real time digitization and recording on computer compatible tape. Author

N81-20340# Naval Research Lab., Washington, D. C. Search Radar Branch.
COMPARATIVE TESTS BETWEEN TIESPAD AND SPA-66 RADAR DISPLAY Final Report
P. M. Thiebaud 8 Dec. 1980 20 p refs
(AD-A095643; NRL-MR-4392) Avail: NTIS HC A02/MF A01 CSCL 17/9

Comparative tests were run between TIESPAD and the AN/SPA-66, a product-line shipboard PPI display. The Time Encoded Spatial Display (TIESPAD) is a radar video processing unit designed and built by Naval Ocean Systems Center. It is a 512 x 512 resolution scan converter with additional processing and memory to accomplish the time compression task using solid-state memory; the output is displayed on a TV monitor. The tests were run using a combination of recorded live radar video and target simulator video. The tests were made to compare a radar operator:s ability to detect targets in random noise, track a single target through heavy clutter, and track multiple targets. The following conclusions were reached: (1) Tracking in clutter is more efficient on TIESPAD than on SPA-66; (2) Detection efficiency is approximately equal on each; (3) Perceived signal-to-noise ratio is degraded on TIESPAD; (4) Higher resolution scan converter is desirable; and (5) Operator controls need improvement. GRA

N81-20341# SRI International Corp., Menlo Park, Calif.
LIDAR OBSERVATIONS AT 0.7 MICROMETERS AND 10.6 MICROMETERS WAVELENGTHS DURING SMOKE WEEK 2 Final Report
Edward E. Uthe Nov. 1980 86 p refs
(Contract DAAG29-77-C-0001; DA Proj. 1L1-62111-AH-71) (AD-A095356; ERADCOM/ASL-CR-80-0001-1) Avail: NTIS HC A05/MF A01 CSCL 17/5

A 10.6 micron wavelength lidar was operated by the U.S. Army Atmospheric Sciences Laboratory and a 0.7 micron wavelength lidar (Mark IX) was operated by SRI International to observe smoke and dust clouds generated during Smoke Week 2 at Eglin AFB from 6 through 16 November 1978. The lidars observed cloud backscatter along horizontal paths that were nearly coincident with those observed by visible and infrared transmissometers operated by the Dugway Proving Ground. The lidar observed paths were terminated with a passive reflector so that time-dependent transmission over the lidar-to-target path could be evaluated from lidar observed target returns. Backscatter signatures for both lidars were digitized and recorded on magnetic tape using the Mark IX lidar data processing system. Recorded lidar data were used to generate intensity-modulated TV displays depicting cloud structure along lidar observed paths as a function of time. These displays were used to choose sixteen Smoke Week 2 trials for quantitative analysis in terms of cloud attenuation and path-integrated backscatter. Transmissions derived from lidar target returns agreed very well with transmissometer records, except for phosphorus events for which the lidar values were greater by as much as an order of magnitude. This discrepancy can be explained because the transmissometer paths were nearer to the surface than the lidar paths and other observations indicated that phosphorus clouds greatly decrease in optical density in the vertical. GRA

N81-20342# Swedlow, Inc., Garden Grove, Calif.
MOLDING OF POLYPROPYLENE FILM ARMOR FOR RADAR ANTENNA HARDENING APPLICATIONS Final Report, 31 May 1977 - 15 Sep. 1980
Glenn A. Cook Jan. 1981 51 p
(Contract DAAB07-77-C-0476)
(AD-A095726; SI-ER-915; AMMRC-TR-80-54) Avail: NTIS HC A04/MF A01 CSCL 17/9

The general objective of this project was to establish a production capability for rigid armor panels molded from cross-plied, unidirectionally oriented polypropylene film. Armor of this type has applicability as a radome material. The purpose of establishing this production capability is to provide for the contingency of meeting estimated military needs for a period of two years after completion of the contract and, to establish a base and plans which may be used to meet expanded requirements. to fulfill the stated objective it was necessary to complete the following tasks: Engineering Sample Phase: design and proof tooling; verify processes which were furnished at the beginning of the project; and preliminary testing; Confirmatory Sample Phase: fabrication of sufficient samples using the established process for more comprehensive testing; and testing of samples; and Demonstration Phase: document process used and equipment required; and brief interested parties and conduct complete process demonstration. These tasks were successfully performed and the general objective of this project has been achieved. A production capability for polypropylene armor has been established, and in the process, opportunities for additional process advances have been identified. GRA

N81-20343# Stanford Univ., Calif. Electronics Labs.
ULF/LOWER-ELF ELECTROMAGNETIC FIELD MEASUREMENTS IN THE POLAR CAPS Final Report, 1 Feb. 1974 - 31 Oct. 1979
A. C. Fraser-Smith Dec. 1980 83 p refs
(Contract N00014-79-C-0174)
(AD-A095283; SU-SEL-E718-1) Avail: NTIS HC A05/MF A01 CSCL 08/6

A review is given of the known properties of naturally-occurring ULF/lower-ELF (0.22-100 Hz) electromagnetic pulsations in the polar caps. Because polar cap measurements by Western scientists in this particular frequency range have been surprisingly limited (even when allowance is made for the logistical difficulties), emphasis is given in the review (1) to a description of the gaps in our knowledge of the properties of the pulsations, and (2) to the uniqueness of the geomagnetic field configuration in the polar caps and its implications. Given the gaps in knowledge and the unique field configuration, the opportunities for innovative research on ULF/lower-ELF electromagnetic pulsations in the polar caps appear to be particularly promising. GRA

N81-20344# Battelle Columbus Labs., Ohio.
ARI IMAGE INTERPRETATION RESEARCH 1970 - 1980
Thomas E. Jeffrey, Harold Martinek (Army Research Inst.), Uldi Shivern (Army Research Inst.), and Edgar M. Johnson (Army Research Inst.) Alexandria, Va. Army Research Inst. for the Behavioral and Social Sciences Jul. 1980 118 p refs
(Contract DAAG29-76-D-0100; DA Proj. 2Q1-62722-A-765) (AD-A095661; ARI-RR-1252) Avail: NTIS HC A06/MF A01 CSCL 05/8

Image interpretation research conducted by the Army Research Institute has produced scientific data on improving the extraction of information from surveillance displays and on the efficient storage, retrieval, and transmission of this information. This report summarizes research on image interpretation completed by ARI between 1970 and 1980, organized according to nine major problem areas. The text presents, for each area, the rationale of ARI's approach to the problem, findings, operational applications, and further research requirements. The research areas are image interpretability, real-time and near real-time imagery interpretation, man/computer decision, processes, change detection, mensuration and coordinate determination, training and proficiency maintenance, key development, and reconnaissance resource management and utilization. Continued utilization of these research findings can enhance the performance of the human component in current systems as well as provide information to system developers to help them provide design specifications for future systems and to determine areas needing further research. GRA

N81-20345# Ohio State Univ., Columbus. ElectroScience Lab.
ELECTROMAGNETIC SCATTERING BY OPEN CIRCULAR WAVEGUIDES Ph.D. Thesis
T. W. Johnson and D. L. Moffatts Dec. 1980 133 p refs
(Contract N00014-78-C-0049)
(AD-A095554; ESL-710816-9) Avail: NTIS HC A07/MF A01 CSCL 20/14

Open circular waveguides are used to model jet engine inlets. The exact Wiener-Hopf solution for scattering by a semi-infinite cylinder is studied in the resonance region, where the cylinder diameter is of the order of a wavelength. In particular, the Wiener-Hopf factorization functions are calculated by numerical integration and compared to various approximations, to define regions of validity. Scattering from the rim is studied as a function of frequency, incidence angle, and time. A ray-optic model for

rim backscatter is discussed. The relative power absorption of the five lowest order waveguide modes is evaluated. Coupling of incident plane waves to waveguide modes, and radiation by these modes are shown to be related by reciprocity. The waveguide termination model for a jet engine assumes an incident wave-guide mode strikes an axially symmetric cone on a flat plate. The various techniques for evaluating scattering by this structure are discussed, and the problem is solved for a few cases. GRA

N81-20346# Connecticut Univ., Storrs. Dept. of Electrical Engineering and Computer Science.
BOUNDS ON TRANSMISSION DELAYS FOR THE CCRA
Leonidas Georgiadis and Kazakos P. Papantoni Jan. 1981 30 p refs
(Grants AF-AFOSR-3695-78; NSF ECS-79-08815; AF Proj. 2304)
(AD-A095658; EECS-TR-81-2; AFOSR-81-0133TR) Avail: NTIS HC A03/MF A01 CSCL 17/2

In this paper, we are concerned with the per packet transmission delays induced by the Capetabakis collision resolution protocol for infinitely large number of identical bursty users. We first correct the existing lower and upper bounds on the expected per packet transmission delay E(D). Then, we proceed by developing a new upper bound on E(D). This new bound is much tighter approaching the lower bound for large arrival rates. GRA

N81-20347# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Electrical Computer and Systems Engineering.
ADAPTIVE SPREAD SPECTRUM RECEIVER USING ACOUSTIC SURFACE WAVE TECHNOLOGY Final Report, 15 Aug. 1977 - 15 Nov. 1980
P. Das and L. B. Milstein 15 Jan. 1981 18 p refs
(Contract DAAG20-79-C-0192; Grant DAAG29-77-G-0205)
(AD-A095737; MA-ARO-F1; ARO-15004.16-EL) Avail: NTIS HC A02/MF A01 CSCL 20N

The objective of this research project can be broadly classified as theoretical study and implementation of spread spectrum communication systems using surface acoustic wave technology. Significant progress has been made in the last 39 months towards this goal. Some of these are: (1) Measurement of the probability of error curve for a spread spectrum receiver implemented with real time SAW Fourier transformer, and (2) Theoretical study of the receiver including the removal of narrowband jamming. The details of this research have been published in 14 papers and one report and presented at 11 technical conferences. GRA

N81-20348# Army Materiel Command, Redstone Arsenal, Ala. Advanced Sensors Directorate.
IMPACT OF SYSTEM ERRORS ON TMR PROCESSING Final Technical Report
August W. Rihaczek 1 Jan. 1981 39 p refs
(AD-A095382; AD-E950090; DRSMI-RE-CR-81-7) Avail: NTIS HC A03/MF A01 CSCL 17/9

This report addresses the question of what requirements are placed on the hardware quality in order to provide adequate capabilities when using target motion resolution (TMR) techniques in a realistic environment. GRA

N81-20349# SRI International Corp., Menlo Park, Calif. Remote Measurements Lab.
MEASUREMENTS OF POSSIBLE D- AND E-REGION TELECOMMUNICATIONS EFFECTS DURING IONOSPHERIC HEATING Final Report
R. L. Showen Feb. 1980 35 p refs
(Contract DE-AI01-80ER-10160; SRI Proj. 8595)
(DOE/ER-10161/1) Avail: NTIS HC A03/MF A01

Measurements were made of the effects that heating the ionosphere might have on the passage of radiowaves through the D and E regions. The effects of the solar power satellite microwave power beam on the lower ionosphere were simulated. The increased electron temperatures produced by a HF ionospheric heater caused cross modulation on certain radiowaves when the heater was rapidly modulated (the Luxembourg effect). Small amounts of cross modulation were detected at four frequencies between 60 kHz and 5 MHz. Attempts were made to detect phase path changes indicative of electron number density changes while the heater was slowly cycled on and off. No phase path changes was observed for radiowaves of frequency 10.2 or 60 kHz. If these results are extrapolated to the powers and frequency of the solar power satellite power beam, then no significant impact from D and E region modification on telecommunications services are expected. DOE

N81-20350# Royal Aircraft Establishment, Farnborough (England).
AN INVESTIGATION OF HIGH FREQUENCY PROPAGATION OVER AN AURORAL SUB-AURORAL PATH
J. B. Dawes London HMSO Sep. 1980 40 p refs
(RAE-TM-RAD-NAV-138; BR76254) Avail: NTIS HC A03/MF A01

Methods of determining the usable frequencies over a particular auroral sub-auroral path such that digital data may be sent uncorrupted, are described. Tests including flight trials took place between April and July 1980 using transmissions between northern Norway and southern England. Computer programs were used to determine the viability of linearly interpolating the ionospheric propagation parameters from sub-auroral areas to an auroral or polar zone. One of the programs is included. Predicted values of the ionosphere give more reliable results than ionosonde data. Interpolation of the ionospheric parameters over these zones has limited use, however, due to the variablity of the ionosphere with northerly latitude. Author (ESA)

N81-20351# Technical Cooperation Program, Redstone Arsenal, Ala. Technical Panel KTP-3.
HARDWARE IMPLEMENTATIONS OF FOURIER TRANSFORM SIGNAL PROCESSING Final Report
J. B. G. Roberts, D. Greenhalgh, and G. M. Dillard Jan. 1980 63 p refs
(PB81-123200; TTCP/KTP3-80/1; TR-3) Avail: NTIS HC A04/MF A01 CSCL 17I

Both digital and analogue methods for implementing discrete and continuous Fourier transforms are reviewed with some discussion of Number-theoretic transforms in connection with fast convolution. Topics Cover: (1) special digital algorithms for the discrete Fourier transform (DFT); (2) Fast Fourier transform (FFT) methods which are now the pre-eminent family of algorithms for computing the DFT; and (3) methods involving analogue components (charge coupled devices, surface acoustic wave filters and optics) which are normally applied in order to gain speed or to reduce costs with some sacrifice in accuracy. GRA

N81-20807# Philips Research Labs., Redhill (England).
REAL-TIME GREY-LEVEL HISTOGRAM MANIPULATION
L. H. Guildford *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 12 p refs (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N81-20352*# National Aeronautics and Space Administration. Pasadena Office, Calif.
CONTROLLER FOR COMPUTER CONTROL OF BRUSHLESS dc MOTORS Patent
Lester S. Hieda, inventor (to NASA) (JPL, California Inst. of Tech., Pasadena) Issued 3 Feb. 1981 23 p Filed 23 Mar. 1979 Supersedes N79-20315 (17 - 11, p 1421) Sponsored by NASA
(NASA-Case-NPO-13970-1; US-Patent-4,249,116; US-Patent-Appl-SN-023484; US-Patent-Class-318-254; US-Patent-Class-318-138; US-Patent-Class-318-439) Avail: US Patent and Trademark Office CSCL 09C

A motor speed and torque controller for brushless dc motors

provides an unusually smooth torque control arrangement. The controller provides a means for controlling a current waveform in each winding of a brushless dc motor by synchronization of an excitation pulse train from a programmable oscillator. Sensing of torque for synchronization is provided by a light beam chopper mounted on the motor rotor shaft. Speed and duty cycle are independently controlled by controlling the frequency and pulse width output of the programmable oscillator. A means is also provided so that current transitions from one motor winding to another is effected without abrupt changes in output torque.
Official Gazette of the U.S. Patent and Trademark Office

N81-20353 Michigan Univ., Ann Arbor.
CONTROLLED AVALANCHE TRANSIT-TIME TRIODE AMPLIFIERS Ph.D. Thesis
Shiuh-Wuu Lee 1980 219 p
Avail: Univ. Microfilms Order No. 8106175

The theoretical effects of avalanche multiplication and collector transit time on microwave controlled avalanche transit-time triode devices were studied. A dc computer program was developed which calculates the dc avalanche multiplication factor vs. base collector dc bias characteristics. The results provide an estimation of the suitability of various semiconductor materials, optimum collector geometrical structures and doping densities.
Dissert. Abstr.

N81-20354 Wisconsin Univ. - Madison.
THE CALCULATION OF THE CURRENT-GAIN OF BIPOLAR TRANSISTORS AND THE THEORY FOR THE FORWARD-BIASED P-N JUNCTION AT ALL INJECTION LEVELS Ph.D. Thesis
Dooie Cherkot Thomas 1980 100 p
Avail: Univ. Microfilms Order No. 8023440

The abrupt forward biased p-n junction is solved for its terminal characteristics and injection efficiency for all values of forward bias. This is accomplished by using a three region approach and formulating the transport problem in terms of the local product of the hole and electron concentrations. Analytic solutions are are derived for low, medium and high injection levels. The base transport factor of bipolar transistors is determined accurately as a function of current by using Shockley-Read-Hall recombination theory. The current gain of bipolar transistors is then easily obtained. The current gain at low currents is controlled by the recombination in the emitter base transition region. The peak gain is generally controlled by the base bulk recombination current. At high currents a quasi charge neutral region is induced in the collector next to the collector base metallurgical junction. The recombination in this region causes a rapid deterioration of the current gain. Dissert. Abstr.

N81-20355 Iowa State Univ. of Science and Technology, Ames.
DETERMINATION OF THE DEGREE OF OBSERVABILITY IN LINEAR CONTROL SYSTEMS Ph.D. Thesis
Fredric Marvin Ham 1980 197 p
Avail: Univ. Microfilms Order No. 8106015

A method to determine the degree of observability in linear control systems is developed. The method outlined in this research is referred to as the stochastic approach, which is based on Kalman filtering theory. The degrees of observability, or relative observability, in the system can be determined by calculating eigenvalues of a normalized error covariance matrix in the Kalman filter. A large eigenvalue indicates weak observability, whereas a small one indicates strong observability. The associated eigenvectors indicate the direction of weak and strong observability, respectively. Absolute estimation error can be determined from the variance terms of the unnormalized error convariance matrix, after cycling through the Kalman filter a number of iterations. These values can then be compared to the corresponding values in the initial error covariance matrix. Dissert: Abstr.

N81-20356 Iowa State Univ. of Science and Technology, Ames.
WIND GENERATOR NETWORK METHODOLOGY AND ANALYSIS Ph.D. Thesis
James Neils Peterson 1980 115 p
Avail: Univ. Microfilms Order No. 8106042

The methodology of optimal allocation of wind generators was developed and was applied to actual hourly wind speed data from six known windy sites in the Pacific Northwest. The problem of selecting the best combination of n wind generator sites out of a possible N sites (for n less than N) was also examined. A hypothetical network consisting of three wind generator sites was investigated prior to analyzing the actual wind speed data. By allocating unequal numbers of wind generators to the different sites, the total network power variance was minimized. The number allocated to each site was determined as a function of the wind power mean values and variances at each site as well as the site to site correlations in wind power fluctuations. Network power variances were given as a function of the correlation coefficient between two of the sites. A comparison was made of the network variances for both equal and optimal allocations of the wind generators at the three sites. Dissert. Abstr.

N81-20357 Virginia Univ., Charlottesville.
APPLICATIONS OF CCD AND SAW DEVICES TO IMAGE PROCESSING Ph.D. Thesis
Juan Ricardo Pimentel-Flores 1980 154 p
Avail: Univ. Microfilms Order No. 8026645

Some image processing problems such as image bandwidth reduction and image filtering are formulated as one dimensional problems and solved using one dimensional techniques. It is shown theoretically through the use of the rate distortion function that image bandwidth reduction problems treated using one dimensional processing are equivalent to the usual treatment involving two dimensional processing. This is verified by computer simulation using the discrete cosine transform. Two image bandwidth reduction processors based on CCD & SAW devices are presented. It is shown that when the length of the discrete cosine transform is large, the direct transform error due to device inaccuracies remains approximately constant, while the inverse transform error varies roughly with the square root of the number of points. Image filtering techniques are shown to be realized using programmable transversal filters. It is concluded that CCD and SAW systems will be practical if high accuracy is not required, but speed and cost are concerns. Dissert. Abstr.

N81-20358# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ELECTRIC CONDUCTION IN N-TYPE GERMANIUM AND CADMIUM SULFIDE
daSilva A. Ferreira, I. C. daCunhaLima, and M. Fabbri Nov. 1980 15 p refs Submitted for publication
(INPE-1950-RPE/266) Avail: NTIS HC A02/MF A01

The impurity conduction of n-type Ge and CdS is calculated via a previously developed theory for impurity bands in doped semiconductors. Rough agreement with experimental data over a wide range of impurity concentration is found. The comparison with AMO-MT calculation shows a big enhancement due to a stronger electron correlation. Author

N81-20359*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THREE-AXIS ELECTRON-BEAM TEST FACILITY
James A. Dayton, Jr. and Ben T. Ebihara Mar. 1981 8 p
(NASA-TP-1836; E-582). Avail: NTIS HC A02/MF A01 CSCL 09C

An electron beam test facility, which consists of a precision multidimensional manipulator built into an ultra-high-vacuum bell jar, was designed, fabricated, and operated at Lewis Research Center. The position within the bell jar of a Faraday cup which samples current in the electron beam under test, is controlled by the manipulator. Three orthogonal axes of motion are controlled by stepping motors driven by digital indexers, and the positions are displayed on electronic totalizers. In the transverse directions, the limits of travel are approximately + or - 2.5 cm from the center with a precision of 2.54 micron (0.0001 in.); in the axial direction, approximately 15.0 cm of travel are permitted with an accuracy of 12.7 micron (0.0005 in.). In addition, two manually operated motions are provided, the pitch and yaw of the Faraday cup with respect to the electron beam can be adjusted to within a few degrees. The current is sensed by pulse transformers and the data are processed by a dual channel box car averager with a digital output. The beam tester can be operated manually or it can be programmed for automated operation. In the automated mode, the beam tester is controlled by a microcomputer (installed at the test site) which communicates with a minicomputer at

the central computing facility. The data are recorded and later processed by computer to obtain the desired graphical presentations. Author

N81-20360*# Denver Univ., Colo.
THE 31.4 GHz PARAMETRIC AMPLIFIER Final Report, 16 Mar. 1973 - 30 Nov. 1977
Jochen Edrich Jan. 1978 5 p refs
(Contract NAS5-23190)
(NASA-CR-166643; Rept-4872-6) Avail: NTIS HC A02/MF A01 CSCL 09A

A degenerate parametric amplifier for 31.4 GHz was studied, designed and constructed. Good mechanical stability and a wide bandwidth of about 800 MHz were achieved using Schottky barrier varactors mounted in specially designed Sharpless wafers and a fixed tuned amplifier mount. Author

N81-20361# Naval Research Lab., Washington, D. C. Plasma Theory Branch.
SELF-CONSISTENT NONLINEAR SLOW-TIME SCALE FORMULATION AND SIMULATION OF OVERMODED GYROTRON OSCILLATORS AND AMPLIFIERS
J. L. Vomvoridis and P. Sprangle 13 Feb. 1981 67 p refs
(Contract EX-77-A-34-1015; RR0110941)
(AD-A095360; NRL-MR-4426) Avail: NTIS HC A04/MF A01 CSCL 09/1

The gyrotron (or, electron cyclotron maser) operates on the interaction of a TE cavity mode with the relativistic electron cyclotron beam mode. This instability has been seen both theoretically and experimentally to be a very efficient source for microwave generation, useful for the heating of Tokamak plasmas at the electron cyclotron frequency. The next generation of Tokamaks involves high confining fields and accordingly the gyrotron must produce short (approx. 2mm) wavelength radiation, which can be realized only by a highly overmoded operation of the gyrotron. This work presents the groundwork for the study of such an overmoded operation. The self-consistent nonlinear equations have been obtained for the evolution of the electron distribution and of the power spectrum for multimode gyrotron interactions in a rectangular cavity or waveguide. The time step of the resulting algorithm is limited only by the nonlinearities and nonuniformities, and therefore yields very efficient simulations. The equations have been applied to the following cases: (a) in a waveguide, analytically, to obtain the dispersion relation and saturation behavior of a monochromatic wave with two dimensional transverse structure; (b) in a waveguide, numerically, to test the correctness and accuracy of the computer code; (c) in a waveguide with external field (or equivalent) nonuniformities, to interpret the associated efficiency enhancement; and (d) in a two mode cavity, to study the evolution and saturation of the eigenmodes. GRA

N81-20362# Tri-Con Associates, Inc., Cambridge, Mass.
DESIGN, FABRICATION AND TESTING OF A SATELLITE ELECTRON BEAM SYSTEM Final Report, 1 Jan. 1975 - 31 Dec. 1979
William B. Huber Hanscom AFB, Mass. AFGL 16 May 1980 56 p
(Contract F19628-75-C-0114; AF Proj. 6690)
(AD-A095362; C-140; AFGL-TR-80-0161) Avail: NTIS HC A04/MF A01 CSCL 09/1

Contents: Introduction and Overview - Original Contract Specifications, Scientific Objectives of the Satellite Electron Beam System, Investigation of the Machlett EE65-1 Gun at Other Than Design Levels, Development of One Flight Model of SEBS, Contract Modifications, Description of SPIBS, Scientific Objectives of SPIBS, Qualification and Acceptance Testing of Both Instruments, Acceptance Testing of Flight Models of Both Instruments, Integration into the SCATHA Satellite, Space Vehicle Environmental Tests, Tests at GSFC and ETR, Launch and On-Orbit Tests; Details of the Satellite Electron Beam System Design - Machlett EE65 Electron Gun Description, Results of Gun Tests at Low Energies, Definition of System Design with Power Constraints Using Test Results, Power Supply Design, Beam Current Level Control, Performance Restrictions Caused by Dynamic Range Requirements, Telemetry Interface Circuits, and Special Ground Test Equipment. GRA

N81-20363# Varian Associates, Palo Alto, Calif.
THE 200 kV LINEAR BEAM SWITCH TUBE DEVELOPMENT Final Technical Report, 31 Jul. 1978 - 31 Aug. 1980
Dennis Boilard Griffiss AFB, N. Y. RADC Nov. 1980 68 p
(Contract F30602-78-C-0232; AF Proj. 4506)
(AD-A095505; RADC-TR-80-357) Avail: NTIS HC A04/MF A01 CSCL 09/1

This report covers the design, fabrication and processing of a linear beam pentode switch tube developed by Varian for RADC. Earlier models were developed by Varian for RADC. Earlier models were developed for Varian under Air Force sponsorship. Design goals were 200 kV video output at 180A load current and 0.04 (0.02 min) duty cycle at pulse lengths up to 100 usec. Important features are the nonintercepting grid convergent electron beam passing through the anode intermediate electrode and voltage depressible collector probe system. The intermediate electrode is positioned between cathode and anode. Primary function of the electrode is to limit the dc voltage in the gun region between electrodes, to about 125 kVdc. No beam tests were done by the contractor. Report includes recommended values for tube operating parameters. GRA

N81-20364# Edgerton, Germeshausen and Grier, Inc., Salem, Mass.
HIGH VOLTAGE, LOW INDUCTANCE HYDROGEN THYRATRON STUDY PROGRAM Final Report, 4 Sep. 1978 - 3 Mar. 1980
Robert F. Caristi and David V. Turnquist Jan. 1981 131 p refs
(Contract DAAB07-78-C-2977; DA Proj. 1L1-62705-AH-94)
(AD-A095278; DELET-TR-78-2977-F) Avail: NTIS HC A07/MF A01 CSCL 09/1

The second phase of a multi-phase program of research and development to gain the information necessary to fabricate a high voltage, low inductance hydrogen thyratron switch has now been completed. The thyratron is to be capable of switching tens of kiloamperes within tens of nanoseconds at voltage levels as high as 250 kV. To achieve low inductance, the thyratron is operated within a close-fitting coaxial current return. Both the tube and the return are made physically short, and the tube is designed such that the discharge is constrained to flow principally at the outer reaches of the device. A technique has been developed for modelling various types of box grids and then using computer-generated field plots to aid in the specifics of grid design. This model has been used to generate a comprehensive set of theoretical relations that are useful to determine the anode dissipation to be expected. Experimental results are described and discussed. Included are the ceramic test results, holdoff vs. time on charge and gas pressure, stage voltage addition, operation at high pulse repetition rates, current rise time as a function of gas pressure, and the triggering characteristics of multi-stage, box-grid tubes. Finally, the design of an intermediate experimental tube is discussed at length. This tube is expected to have an inductance less than 50 nH and to operate at 150 kV. Its design is based on both the theoretical and experimental results obtained during this phase of the research program. The overall conclusion is that a hydrogen thyratron capable of achieving the program's objectives is a feasible proposition. GRA

N81-20365# Duracell International, Inc., Burlington, Mass. Lab. for Physical Science.
ANALYSIS OF THE LITHIUM SULFUR DIOXIDE SYSTEM AT ULTRA-HIGH RATE DISCHARGES Final Report, Sep. 1979 - 30 Sep. 1980
R. W. Holmes and A. N. Dey Fort Monmouth, N.J. ERADCOM Feb. 1981 81 p refs
(Contract DAAK20-79-C-0273; DA Proj. 1L1-62705-AH-94)
(AD-A095549; DELET-TR-79-0273-F) Avail: NTIS HC A05/MF A01 CSCL 09/1

The major objective of this program was to study the effects of electrolytes in Li/SO2 cells, for use in high rate abusive discharge conditions. Five electrolytes were investigated based on previous differential thermal analysis (DTA) results. A standard type electrolyte using acetonitrile (AN) was included in the program for comparison. The work was performed at Duracell International Inc. using LO26SX cells made at the Lithium Systems Division in North Tarrytown, New York. The cells were filled and tested at the Laboratory for Physical Science in Burlington,

Massachusetts. Two electrolytes, AN (standard) and AN/PC (90/10) were found satisfactory for use in high rate abuse discharge conditions. Cells with AN/AA (90/10) electrolyte were satisfactory when fresh but these cells evolved CO2 on storage at 55 C and 72 C which led to severe cell-leakage. The remaining electrolytes, AN/BL/DME (85/10/5), PC/DME (50/50) and BL/DME (50/50), were regarded unsatisfactory for use in Li/SO2 cells for high rate abusive discharge conditions. The use of copper foil as the anode substrate was studied in LO26SX cells filled with the standard AN electrolyte. These cells were effective in reducing the sharp voltage reversal during abusive forced discharge at 2.0A at -30 C. The abuse resistance of these cells was at least as good as that of the standard cells. GRA

N81-20366# Oak Ridge National Lab., Tenn.
HIGH VOLTAGE RESEARCH (BREAKDOWN STRENGTHS OF GASEOUS AND LIQUID INSULATORS) AND ENVIRONMENTAL EFFECTS OF DIELECTRIC GASES Semiannual Report, 1 Apr. - 30 Sep. 1980
L. G. Christophorou, D. R. James, R. Y. Pai, R. A. Mathis, I. Sauers, D. H. Smith, L. C. Frees, M. O. Pace, D. W. Bouldin, C. C. Chan et al Jan. 1981 129 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7624) Avail: NTIS HC A07/MF A01

Electron attachment rate constants for five halogenated ethylene compounds were measured in two background gases, and the corresponding attachment cross sections, sigma/sub a/(epsilon), were calculated. Electron attachment rates were also measured for two perfluoroalkanes, and the attachment cross sections calculated. Initial decomposition products of n-C5F12 are being studied. Breakdown strength shows strong dependence on the magnitude and energy dependence of the electron attachment cross section. The problem of compressibility of some dielectric gases is considered as well as the breakdown of several fluorochlorohydrocarbon gases. The effect of mixture components and proportions was observed on corona stabilization of breakdown. The applied testing concentrated on cylindrical geometry tests with smooth and rough electrodes to systematically determine optimum ternary mixtures of two attaching gases (SF6 and c-C4F8) with one moderating gas (either N2 or 1,1,1-C2H3F3 or CHF3). DOE

N81-20367# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
MICROSTRUCTURE AND PROPERTIES OF A15 SUPERCONDUCTORS FORMED BY DIRECT PRECIPITATION
M. Hong, D. R. Dietderich, I. W. Wu, and J. W. Morris, Jr. Sep. 1980 5 p refs Presented at the Appl. Superconductivity Conf., Santa Fe, N. Mex., 29 Sep. - 2 Oct. 1980
(Contract W-7405-eng-48)
(LBL-11605; CONF-800980-35) Avail: NTIS HC A02/MF A01

Superconducting materials were made by quenching supersaturated solutions of V-Ga and Nb-Al, deforming the quenched specimens, and then precipitating the A15 phase by aging at intermediate temperature. The critical current characteristics of the product materials depend both on the inherent properties of the A15 phase, which presumably reflect its composition, and on details of the precipitation process, which determine the grain size, continuity, and volume fraction of the A15. These features or the precipitation process differ qualitatively between V-Ga and Nb-Al. They are described and used to interpret the critical current characteristics. DOE

N81-20368# California Univ., Livermore. Lawrence Livermore Lab.
EFFECTS OF STRAIN ON THE SUPERCONDUCTING PROPERTIES OF NIOBIUM-TIN CONDUCTORS Ph.D. Thesis
R. W. Hoard Nov. 1980 226 p refs
(Contract W-7405-eng-48)
(UCRL-53069) Avail: NTIS HC A11/MF A01

An attempt was made to ascertain additional information on the connection between the cubic to tetragonal martensitic phase transformation and the phenomenon of superconductivity in Nb3Sn. Particular emphasis was placed on the degradation of the critical parameters, such as T sub c, H sub c2, and J sub c, with mechanical straining of the superconductor. Information was obtained that assisted in the derivation of the critical current strain scaling laws. DOE

N81-20369# Siemens A.G., Munich (West Germany). Grundlagenentwicklung Halbleitermaterialphysik.
CRYSTAL DEFECTS IN LARGE SCALE INTEGRATED CIRCUITS OF SILICON Final Report
Bernd O. Kolbesen and Kurt R. Mayer Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 143 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-156; ISSN-0340-7608) Avail: NTIS HC A07/MF A01

The influence of process-induced crystal defects on the yield of large scale integrated circuits based on bipolar and MOS technology was investigated. Crystal defects were located by etching and X-ray tomography, then ytudied in detail by high voltage electron microscopy. The mode of the emitter collector reverse characteristics and the storage time served as main evaluation criteria for bipolar and MOS structures, respectively. Particular species of stocking faults and dislocations generated during epitaxy, and certain oxidation and diffusion processes are found to be the main cause of emitter collector shorts ('pipe') in bipolar circuits. Large stocking faults produced in the thick oxide process result in small storage times for MOS capacitors. Metallic impurities or gettering methods the density of crystal defects is shown to be effectively reduced. Author (ESA)

N81-20370# Siemens A.G., Munich (West Germany). Bereich Weitverkehrstechnik.
HIGH POWER AMPLIFIER 14 GHz FOR SATELLITE GROUND STATIONS Final Report
Horst Wuennenberg, Franz Weinzierl, and Heinz Bobeck Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 122 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-158; ISSN-0340-7608) Avail: NTIS HC A06/MF A01

A broadband high power amplifier for the frequency range 14 to 14.5 GHz as well as a travelling wave tube (TWT) for this power amplifier with an output power of 2 kW were developed for application in satellite earthside stations. This equipment is shown to be well adapted to both multicarrier operation (frequency division modulated amplitude) and to pulse code operation (time division modulated amplitude). The design concept of the TWT is outlined, and its construction and high frequency testing are described. The power amplifier was characterized. Significant results comprise not only electrical data, but also operating power gain, bandwidth, and functional linearity. Author (ESA)

N81-20371# AEG-Telefunken, Heilbronn (West Germany). Geschaeftsbereich Halbleiter.
COMBINATION OF INTEGRATED INJECTION LOGIC (IIL) FOR UHF ANALOG CIRCUITRY Final Report
Hermann Clauss and Klaus Woerner Bonn Bundesministerium fuer Forschung und Technologie Apr. 1980 165 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-010; ISSN-0340-7608) Avail: NTIS HC A08/MF A01

Integrated injection switching logic was characterized in bipolar circuit design applications. The influence of epitaxial layer thickness and base layer resistance on IIL inverter switching time was determined. A photolithographic process, involving selective oxidation, which achieves dielectric insulation of the N + zone in a riotpack layer structure is explained. Silicon oxide sputtering of the insulation layer is optimized. Improving metallized surface smoothness. The extension of UHF transistor technology in consequence of IIL component capabilities is then considered. As a practical application a 5 x 2 crosspoint array was fabricated, combining bipolar switching transistors and an IIL matrix control logic network. A monolithically integrated frequency divider for input frequencies up to 1.8 GHz was also designed and built. This device combines seven emitter coupled logic divider stages and nine IIL divider stages. The power consumption is 300 mW. Author (ESA)

N81-20372# Siemens A.G., Munich (West Germany). Zentrallab. fuer Nachrichtentechnik.

TANTALUM ALUMINUM THIN FILM TECHNOLOGY FOR A NEW GENERATION OF MICROWAVE INTEGRATED CIRCUIT APPLICATIONS Final Report

Siegfried Bock, Wolf-Dieter Muenz, Hans-Werner Poetzlberger, and Hermann Zehentmeier Bonn Bundesministerium fuer Forschung und Technologie Jun. 1980 127 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-80-015; ISSN-0340-7608) Avail: NTIS HC A07/MF A01

The use of TaAl RC thin film networks in high frequency applications is considered. The sequently sputtered resistive film and the material for the base electrode of the capacitor are selectively and independently etched. Selective etching is controlled by the difference in aluminum content of each film. The composition of the resistive layer is shown optimal at 50% Ta and 40% Al, while values for the base electrode are 79% Ta and 93% Al. The relatively low series resistance of such electrodes guarantees a good high frequency performance. Temperature coefficient (TC) matching of resistance TC and capacitance TC is achieved by introduction of a sandwich dielectric consisting of an anodic oxide film and a sputtered SIO2 film. The total capacitance TC of the sandwich dielectric is determined by the thickness of the SLO2 film. Processing performance results for the selective etching of single thin film materials show a reduction in photolithographic processing. Indicating the cost attractiveness of this technology. Author (ESA)

N81-20373# AEG-Telefunken, Ulm (West Germany). Forschungsinst.

MONOLITHIC INTEGRATED SEMICONDUCTOR SWITCHES WITH LOW ON-RESISTANCE Final Report

Erich Baechle, Peter Christiansen, Juergen Dangel, Dietrich Hoeppner, Juergen Koehne, Gerhard Kohlbacher, Klaus Schlueter, and Hans Schuessler Bonn Bundesministerium fuer Forschung und Technologie Apr. 1980 218 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-80-016; ISSN-0340-7608) Avail: NTIS HC A10/MF A01

System requirements for the replacement of electromechanical relays in space division PABx switching networks by monolithic integrated semiconductor circuits were studied. Based on these results, balanced 5 x 2 crosspoint arrays combined with a matrix control logic network were fabricated, optimizing for MOS and integrated injection logic (IIL) bipolar technology. The developed circuits satisfy all the requirements of one stage crosspoint arrays. The IIL bipolar matrix can also be used in three stage division telephone exchanges. Extensive tests show that these circuits fulfill the special needs for lifetime and reliability of PABx systems. Author (ESA)

N81-20374# Societe Crouzet, Valence (France). Div. Aerospatiale et Systemes.

DEVELOPMENT OF HYBRID CIRCUITS [DEVELOPPEMENT DE CIRCUITS HYBRIDES. RAPPORT DE SYNTHESE]

Duban and Chesne Paris ESA 6 Jun. 1979 50 p In FRENCH Original contains color illustrations

(Contract ESA-2839/76/HP)

(DH-RS-01; ESA-CR(P)-1243) Avail: NTIS HC A03/MF A01

Five thick film hybrid circuits were developed. The circuits are intended as component modules in a remote terminal unit which is part of an onboard data handling system. The developed circuit functions are: (1) sixteen decoded output switches; (2) input multiplexer; (3) input and output interface; (4) analog interface and sample and hold; and (5) analog digital converter. Operating and electrical characteristics for each circuit are given. Design and fabrication of the modules are described along with prototype testing. A synoptic schematic of each circuit type is provided. Author (ESA)

N81-20375# Siemens A.G., Munich (West Germany). Bereich Weitverkehrstechnik.

DEVELOPMENT OF A PARAMETRIC AMPLIFIER FOR SATELLITE TRANSPONDER APPLICATIONS AT 14 TO 14.5 GHz Final Report

Alexander Loeffler and Michael Niemeyer Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 66 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-W-79-27; ISSN-0170-1339) Avail: NTIS HC A04/MF A01

A breadboard model is presented. The system consists of a parametric amplifier stage employing waveguide/coaxial techniques and a highly insulated very low loss four-gate stripline circulator. A directly oscillating Gunn element, solid state oscillator is used. Typical electrical characteristics are gain (13dB min), bandwidth (500 GHz), gain variation (+ or - 0.85dB max), and noise temperature mean value (300K). A comparison with the results obtained with other designs shows this system to be advantageous from the alignement complexity and reliability points of view. Author (ESA)

N81-20816# Deutsch3 Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Wesseling (West Germany). Inst. fuer Dynamik der Flugsysteme.

A TV-TRACKING SYSTEM BASED ON COMPUTER INTELLIGENCE

Gerhard Hirzinger and Klaus Landzettel *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 7 p refs (For primary document see N81-20803 11-70)

Avail: NTIS HC A12/MF A01

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N81-20376 Rutgers - The State Univ., New Brunswick, N. J.

EXPERIMENTAL AND THEORETICAL INVESTIGATIONS ON THE INFLUENCE OF SHEAR IN DOUBLE DIFFUSIVE CONVECTION Ph.D. Thesis

Sivagnanam Thangam 1980 245 p

Avail: Univ. Microfilms Order No. 8105057

The influence of shear in double diffusive convective systems were investigated with heat and salt as diffusing components. The surface discharge of heated saline jets into ambient with stable, constant, salt gradient was examined. Both three dimensional and two dimensional cases were covered. Salt finger convection in steady shear flow also studied. Both the cases of constant and variable shear were addressed. The results based on a linear stability analysis showed that up to Reynolds number of 10 to the 5th power, the presence of a steady shear stabilizes all perturbations except that with infinite wavelengths in the direction of the shear. Dissert. Abstr.

N81-20377 Johns Hopkins Univ., Baltimore, Md.

PHYSICAL ARGUMENTS AND EXPERIMENTAL EVIDENCE IN SUPPORT OF THE MESOLAYER THEORY OF TURBULENCE Ph.D. Thesis

Tien-Chay Chen 1981 105 p

Avail: Univ. Microfilms Order No. 8106596

Experimental data are studied in light of the mesolayer theories of turbulence developed for a number of problems including flow in a pipe, the boundary layer at zero incidence, and the atmospheric boundary layer. The mesolayer theories take into account the presence of large-scale eddies near the wall. The interaction of big eddies with the surface generate a second boundary layer, called the mesolayer, whose thickness, scaled on the friction velocity u sub tau and viscosity v, is proportional to R(1/2) = (u sub tau H/v)(1/2), where H is the outer length. Inside this layer, both viscosity and the outer length are important. The systematic deviation of mean velocity data about the logarithmic law in pipe-flow and turbulent boundary layer is examined. It varies at R(1/2) and can be attributed to mesolayer effects. Analysis also strongly suggests that some quantities directly connected to the large-scale eddies near the wall scale on the mesolayer thickness. The existence of the mesolayer between

the inner and outer regions prevents the commonly assumed overlap--the logarithmic profile. Dissert. Abstr.

N81-20378 California Inst. of Tech., Pasadena.
SILENT BOUNDARY METHODS FOR TRANSIENT WAVE ANALYSIS Ph.D. Thesis
Martin Cohen 1981 199 p
Avail: Univ. Microfilms Order No. 8105121

A dynanic model, designed to absorb infinitely radiating waves in a finte, computational grid is presented. The analysis is primarily directed toward the problem of soil structure interaction, where energy propagates from a region near a structure, outward toward the boundaries. The proposed method, called the extended-paraxial boundary, is derived from one directional, wave theories. The theory is presented from a more general viewpoint and is studied for its stability properties. This work suggests some modifications to the method as it was first presented. Innovations are also put forward in the boundary's implementation for finite element calculations. These alterations render the boundary an effective wave absorber. Dissert. Abstr.

N81-20379 Georgia Inst. of Tech., Atlanta.
COUPLED FLUID STRUCTURE INTERACTION PROBLEMS, THE CASE OF AN ELASTIC-PLASTIC SHELL AND AN ACOUSTIC FLUID Ph.D. Thesis
Kunal Ghosh 1980 176 p
Avail: Univ. Microfilms Order No. 8105692

The fluid structure interaction problem is formulated in terms of the equations of motion for a shell structure and an integral representation for the pressure on its surface. The integral representation for the pressure on a stationary surface can be obtained by using the classical Kirchhoff's approach. In general, this method cannot be used for a fluid structure interaction problem because the structure is usually not stationary during the interaction with a fluid. Consequently, an integral representation that is valid for surfaces in arbitrary motion is developed. The equations of motion for the shell structure are formulated in a tensorial notation for arbitrarily large deformations of a ring stiffened cylindrical shell. The properties of the stiffeners are averaged over the surface of the shell. The shell and the ring stiffeners are assumed to be made of an elastic plastic material. Dissert. Abstr.

N81-20380 Rutgers - The State Univ., New Brunswick, N. J.
STABILITY OF ROTATIONAL COUETTE FLOW OF DENSITY STRATIFIED FLUIDS Ph.D. Thesis
Chak Man Leung 1980 168 p
Avail: Univ. Microfilms Order No. 8105024

Stability of rotational Couette flow of stratified salt solutions was studied both experimentally and theoretically. Experiments were performed in a concentric cylinder apparatus with the ratio of the radius of the inner cylinder to that of outer cylinder being 0.925 (small gap) and 0.50 (wide gap) respectively. Homogeneous fluids and stratified fluids with four different density gradients were studied. Flow visualization was by means of immersed particles (AQ-1000), dye trace and shadowgraph methods. For a given rotational speed of the outer cylinder, the effect of the stable density gradients was to increase the critical rotational speed of the inner cylinder. A theoretical analysis was carried out using the Galerkin method with polynomials as expansion functions to solve the linearized disturbance equations. The disturbances in the flow field were assumed axisymmetric. Theoretical stability boundaries and wave number were predicted for the small gap case. Dissert. Abstr.

N81-20381 Washington Univ., Seattle.
A UNIFIED THEORY OF LINEAR DIFFUSION IN MULTILAYERED MATERIALS Ph.D. Thesis
Patricia Ellen Wirth 1980 201 p
Avail: Univ. Microfilms Order No. 8103717

A unified theory of linear diffusion in an n layer finite region and in a two semiinfinite layer region is presented. Very general, possibly discontinuous, interface conditions are proposed for this model of composite material. Analytic solutions for both models are described. It is demonstrated that for particular parametric values, the interface conditions reduce to the well known conditions of perfect thermal contact and linear contact resistance. Likewise, the newly introduced conditions of double contact resistance are subsumed by the general model. The n layer finite region model is solved by reducing the problem to a non standard Sturm-Liouville problem with an appropriately defined inner product which defines the natural norm for this type of problem in laminated materials. The solution is compared to previously obtained solutions of the limiting cases. The uniqueness of the solution is assured through an application of the maximum principle. Two examples are examined. The solution to the problem for two semiinfinite layers is achieved through separation of the problem into two standard one semiinfinite layer problems through an appropriately defined mapping. Dissert. Abstr.

N81-20382*# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
DYNAMICS OF CAVITATING CASCADES Final Report
C. E. Brennen and A. J. Acosta Jan. 1980 10 p refs
(Contract NAS8-29313)
(NASA-CR-161673) Avail: NTIS HC A02/MF A01 CSCL 20D

The unsteady dynamics of cavitating cascades and inducer pumps were studied with a view to understanding (and possibly predicting) the dynamic characteristics of these devices. The chronology of the research is summarized as well as the final conculsions for each task. The construction of a dynamic pump test facility and its use in making experimental measurements of the transfer function is described as well as tests conducted using a scale model of the low pressure liquid oxygen turbopump inducer in the shuttle main engine. Auto-oscillation and unsteady inlet flow characteristics are discussed in addition to blade cavity influence and bubbly cavitation. A.R.H.

N81-20383*# Scientific Research Associates, Inc., Glastonbury, Conn.
A THREE-DIMENSIONAL TURBULENT COMPRESSIBLE SUBSONIC DUCT FLOW ANALYSIS FOR USE WITH CONSTRUCTED COORDINATE SYSTEMS Final Report
R. Levy, H. McDonald, W. R. Briley, and J. P. Kreskovsky
Washington NASA Apr. 1981 40 p refs
(Contract NAS3-21735)
(NASA-CR-3389) Avail: NTIS HC A03/MF A01 CSCL 20D

An approximate analysis is presented which is applicable to nonorthogonal coordinate systems having a curved centerline and planar transverse coordinate surfaces normal to the centerline. The primary flow direction is taken to coincide with the local direction of the duct centerline and is hence normal to transverse coordinate planes. The formulation utilizes vector components (velocity, vorticity, transport equations) defined in terms of local Cartesian directions aligned with the centerline tangent, although the governing equations themselves are expressed in general nonorthogonal coordinates. For curved centerlines, these vector quantities are redefined in new local Cartesian directions at each streamwise location. The use of local Cartesian variables and fluxes leads to governing equations which require only first derivatives of the coordinate transformation, and this provides for the aforementioned ease in using constructed coordinates. A.R.H.

N81-20384*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMPUTATION OF UNSTEADY TURBULENT BOUNDARY LAYERS WITH FLOW REVERSAL AND EVALUATION OF TWO SEPARATE TURBULENCE MODELS
Tuncer Cebeci and Lawrence W. Carr Mar. 1981 61 p refs Prepared in cooperation with Army Aviation Research and Development Command, Moffet Field, Calif.
(NASA-TM-81259; A-8438) Avail: NTIS HC A04/MF A01 CSCL 20D

A procedure which solves the governing boundary layer equations within Keller's box method was developed for calculating unsteady laminar flows with flow reversal. This method is extended to turbulent boundar6 layers with flow reversal. Test cases are used to investigate the proposition that unsteady turbulent boundary layers also remain free of singularities. Turbulent flow calculations are performed. The governing equations for both models are solved. As in laminar flows, the unsteady turbulent boundary layers are free from singularities, but there is a clear indication of rapid thickening of the boundary layer with increasing

flow reversal. Predictions of both turbulence models are the same for all practical purposes. S.F.

N81-20385# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Computational Fluid Dynamics Dept.
MEASUREMENTS AND PREDICTIONS OF COMPLEX TURBULENT FLOWS, VOLUME 2
1980 416 p refs Proceedings of 1980 Lecture Ser., Rhode Saint Genese, Belgium 11-15 Feb. 1980 2 Vol.
(VKI-LS-1980-3-Vol-2) Avail: NTIS HC A18/MF A01

A lecture series on fluid dynamics was presented. Topics cover modeling complex turbulent flows and visualizing particle motions in turbulent flows. Laser Doppler anemometry, hot-wire techniques, and various other optical as well as sensor probe measurement methods are discussed. For individual titles, see N81-20386 through N81-20393.

N81-20386# California Univ., Davis.
TURBULENCE TRANSPORT MODELS FOR NUMERICAL COMPUTATION OF COMPLEX TURBULENT FLOWS
Brian E. Launder *In* Von Karman Inst. for Fluid Dynamics Meas. and Predictions of Complex Turbulent Flows, Vol. 2 1980 126 p refs (For primary document see N81-20385 11-34)
Avail: NTIS HC A18/MF A01

Different approaches to describing the behavior of turbulence in mathematical form are reviewed, emphasizing the best available models for use in computing practically important two and three dimensional turbulent flows. The Reynolds form of the equations of motion is discussed, where the Navier-Stokes equations are averaged over a time scale which is long in comparison with all parts of the turbulent motion. The sole manifestations of turbulence in the resultant equations are the time averaged correlations between fluctuating velocity components. The schemes reviewed all fall into the category of single point closures. Author (ESA)

N81-20387# Karlsruhe Univ. (West Germany). Inst. fuer Hydromechanik.
INFORMATION CONTENT OF LDA-SIGNALS AND OPERATIONS OF LDA-SIGNAL PROCESSORS
F. Durst *In* Von Karman Inst. for Fluid Dynamics Meas. and Predictions of Complex Turbulent Flows, Vol. 2 1980 13 p (For primary document see N81-20385 11-34)
Avail: NTIS HC A18/MF A01

Problems encountered in the measurement of locally time-averaged flow properties with laser Doppler anemometer (LDA) systems are discussed. Relevant signal processing theory is explained, and its neglect in LDA operations is criticized. Weighting by sampling techniques is reviewed. Transfer functions for optical systems in general, and LDA systems in particular, are considered. In conclusion, correct time-averaged measurements are possible, but require a minimum particle concentration, e.g., time resolved measurements. The measuring of time-averaged properties can be optimized by taking into account the integral time scale of the flow, e.g., measurements without time resolution. Given the integral time scale of the flow, the integration time can be computed in order to obtain correct time averaged values of the flow within a set accuracy. Author (ESA)

N81-20388# Karlsruhe Univ. (West Germany). Inst. fuer Hydromechanik.
HIGH SPEED VELOCITY MEASUREMENTS USING LASER-DOPPLER ANEMOMETERS
D. Dopheide (Physik.-Tech. Bundesanstalt) and F. Durst *In* Von Karman Inst. for Fluid Dynamics Meas. and Predictions of Complex Turbulent Flows, Vol. 2 1980 17 p refs (For primary document see N81-20385 11-34)
Avail: NTIS HC A18/MF A01

Theoretical investigations carried out to optimize laser Doppler anemometer (LDA) systems for applications in high speed fluid flows are summarized. Most high speed LDA measurements are made at Doppler frequencies much below the frequency capabilities of modern LDA frequency counters. This is explained by a phenomenological description of the multiaxial mode output of cw lasers employed for high speed velocity measurements. The application of photodetectors for high frequency LDA measurements is also considered. It is shown that photomultipliers permitting high anode currents are advantageous in laser Doppler anemometry when applied to high Doppler frequencies.
Author (ESA)

N81-20389# State Univ. of New York at Stony Brook. Dept. of Mechanical Engineering.
ON THE MOTIONS OF PARTICLES IN TURBULENT FLOWS
S. L. Lee and F. Durst (Karlsruhe Univ.) *In* Von Karman Inst. for Fluid Dynamics Meas. and Predictions of Complex Turbulent Flows, Vol. 2 1980 65 p refs Sponsored by Deutsche Forchungsgemeinschaft (DFG), The Nuclear Regulatory Commission and Alexander von Humboldt Foundation (For primary document see N81-20385 11-34)
Avail: NTIS HC A18/MF A01

Theoretical and experimental studies of the behavior of turbulent particle dispersion flows are described. In particular, dispersions of low particle concentration in a turbulent pipe flow are considered, and the particle deposition at the wall is studied. The theoretical treatment is based on an analysis of particle frequency response to the surrounding eddy motion. A scheme which determines the location of the joining boundary between two distinguishable regions of particle transport, i.e., a turbulent diffusion controlled region and a region in which the particle motion is controlled by the mean velocity field of the fluid, is developed. The theoretical considerations are presented for particles of a single size, but extensions of the developed scheme are indicated for polydispersed particle size distributions. Results of experimental investigations carried out in an upward turbulent air flow in a vertical pipe-test-rig are given. Mean velocity profiles for both the fluid flow, and the dispersed particles are presented. Measurements were carried out for various sizes.
Author (ESA)

N81-20390# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
TURBULENT MIXING AND CONCENTRATION MEASUREMENT
C. Borrego and M. L. Riethmuller *In its* Meas. and Predictions of Complex Turbulent Flows, Vol. 2 1980 31 p refs (For primary document see N81-20385 11-34)
Avail: NTIS HC A18/MF A01

A laser Doppler velocimeter and a laser scatter system were used to measure nozzle flow velocity and tracer concentration (oil smoke) in a turbulent air jet of circular cross section exhausting into still air. The flow field was examined at locations varying from two to twenty diameters downstream of the nozzle. Main parameters recorded at each downstream station were mean axial velocity, mean concentration, fluctuating velocity and concentration, and velocity concentration correlation. Effects of turbulence on the mass transfer characteristics of the flow were studied. Results show that the combined laser Doppler velocimeter and laser scatter technique permits an accurate description of the nozzle fluid concentration and velocity fields for a round turbulent free jet. The velocity and concentration profiles exhibit self-preserving properties and close agreement among each other. The centerline velocity and concentration decay are in general agreement with data from other sources. Author (ESA)

N81-20391# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
OPTICAL MEASUREMENTS OF THE DIFFUSION OF A HEAVY GAS IN TURBULENT BOUNDARY LAYER
C. Borrego and M. L. Riethmuller *In its* Meas. and Predictions of Complex Turbulent Flows, Vol. 2 1980 23 p refs (For primary document see N81-20385 11-34)
Avail: NTIS HC A18/MF A01

The downstream behavior of heavy gas (smoke) released in a turbulent boundary layer was studied experimentally, using a wind tunnel model of the atmospheric boundary layer. Point measurements of both concentration and velocity fluctuations were made. To measure the instantaneous velocity component, a laser Doppler velocimeter was used. A laser light scatter system measured concentration. A comparison with more conventional concentration measuring techniques allows for the validation of both methods. The correlations between velocity and concentration show that three regions can be defined in which the flow should be interpreted in completely different manners. Author (ESA)

N81-20392# Centre d'Etudes Aerodynamiques et Thermiques, Poitiers (France).

TURBULENCE MEASUREMENTS IN SUPERSONIC FLOWS

P. Ardonceau *In* Von Karman Inst. for Fluid Dynamics Meas. and Predictions of Complex Turbulent Flows, Vol. 2 1980 28 p refs (For primary document see N81-20385 11-34)

Avail: NTIS HC A18/MF A01

Particular aspects of the application of hot-wire and laser anemometry to supersonic flows are reviewed. It is shown that the main consequence of a high flow velocity on laser anemometry is a decrease in the signal quality and that everything must be done to optimize the signal to noise ratio. Several procedures for hot-wire data reduction are presented, and problems, such as frequency response, are discussed. In conclusion, both methods are shown to be of practical interest and are more complementary than competitive. Nonetheless, a lack of experimental data on compressible turbulence is noted. The reasons are seen as partly due to the methods themselves, but more certainly to the long test time required in supersonic wind tunnels which are energy consuming and thus costly to operate. Author (ESA)

N81-20393# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

HOT WIRE TECHNIQUES: CONDITIONAL SAMPLING AND INTERMITTENCY

D. Olivari *In its* Meas. and Predictions of Complex Turbulent Flows, Vol. 2 1980 110 p refs (For primary document see N81-20385 11-34)

Avail: NTIS HC A18/MF A01

The hot-wire anemometer as a research tool in fluid mechanics is discussed. Different types of probes, their calibration characteristics, and control circuitry are covered. The linearization of the instantaneous response of a hot wire is described algebraically. The angular response of a hot-wire sensor is then treated. Application to the measurement of turbulence as well as some operational problems are shown. The use of a conditional sampling procedure, based on a detection criteria for turbulent flows and triggered by the behavior of the hot-wire signal, is analyzed, emphasizing observation of intermittency at the flow edge.

Author (ESA)

N81-20394# Purdue Univ., Lafayette, Ind.

MEASUREMENTS OF A SEPARATING TURBULENT BOUNDARY LAYER Technical Report, Oct. 1976 - Feb. 1979

Roger L. Simpson, Y.-T. Chew, and B. G. Shivaprasad Apr. 1980 219 p refs Prepared by Southern Methodist Univ., Dallas

(Contract N00014-75-C-1143; NR Proj. 098-038; Proj. SQUID) (AD-A095252; SQUID-SMU-4-PU) Avail: NTIS HC A10/MF A01 CSCL 20/4

The directionally sensitive laser anemometer now provides the ability to accurately measure instantaneous flow direction and magnitude. The experimental results are concerned with a nominally two dimensional separating turbulent boundary layer for an airfoil type flow in which the flow was accelerated and then decelerated until separation. Upstream of separation single and cross wire hot wire anemometer measurements are also presented. Measurements obtained in the separated zone with a directionally sensitive laser anemometer system are presented. Results lead to significant conclusions about the nature of the separated flow when the thickness of the backflow region is small as compared with the shear laer thickness. The backflow is controlled by the large scale outer region flow. The small mean backflow does not come from far downstream, but appears to be supplied intermittently by large scale structures as they pass through the separated flow. Downstream of fully developed separation, the mean backflow appears to be divided into three layers. GRA

N81-20395# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.

MEASUREMENTS OF THE TRANSVERSE VELOCITY OF A SEPARATING TURBULENT BOUNDARY LAYER

Klara Shiloh (Israel Atomic Comm., Yavne), B. G. Shivaprasad, and R. L. Simpson Jun. 1980 78 p refs Prepared by Southern Methodist Univ., Dallas

(Contract N00014-79-C-0277; Proj. SQUID) (AD-A095256; SQUID-SMU-5-PU) Avail: NTIS HC A05/MF A01 CSCL 20/4

The problem of turbulent boundary layer separation due to an adverse pressure gradient is an old but still important problem in many fluid flow devices. Until recent years, little quantitative experimental information was available on the flow structure downstream of separation because of the lack of proper instrumentation. The directionally-sensitive laser anemometer now provides the ability to accurately measure the instantaneous flow direction and magnitude. Simpson, Chew, and Shivaprasad (1980) presented a number of experimental results for a nominally two dimensional separating turbulent boundary layer for an airfoil-type flow in which the flow was accelerated and then decelerated until separation. Upstream of separation single and cross-wire hot-wire anemometer measurements were also presented. In addition to confirming the earlier conclusions of Simpson et al. (1977), these results provided new insights about the separated flow region. From that work, the backflow appears to be supplied by the large eddy structure rather than coming from far downstream. It also was suggested that downstream of fully-developed separation the mean backflow could be divided into three layers: a viscous layer nearest the wall that is dominated by the turbulent flow unsteadiness but with little Reynolds shearing stress effects; a rather uniform mean velocity intermediate layer that seems to act as an overlap region between the viscous wall and outer regions; and the outer backflow region that is really part of the large-scaled outer region. The results presented here support the earlier flow model of Simpson et al. GRA

N81-20396# Georgia Inst. of Tech., Atlanta.

UTILIZATION OF AN EFFICIENT NUMERICAL METHOD FOR VISCOUS FLOW PROBLEM SOLUTIONS Final Report, 4 Jan. - 31 Dec. 1980

J. C. Wu 10 Feb. 1981 7 p refs

(Contract DAAG29-80-C-0015)

(AD-A095758; ARO-16674.1-E) Avail: NTIS HC A02/MF A01 CSCL 12/1

This report describes two workshops organized and conducted at two U.S. Army Laboratories for the purpose of transfering new knowledge and new techniques developed for the use of the integral-representation approach in computing complex viscous flows. GRA

N81-20397# Aerospace Corp., El Segundo, Calif. Information Processing Div.

THE AEROSPACE THERMAL MODEL (HFLUX): ITS STRUCTURE AND UTILITY Interim Report

Joseph K. Dodd 1 Dec. 1980 29 p refs

(Contract F04701-80-C-0081)

(AD-A095359; TR-0081(6638-05)-1; SD-TR-80-81) Avail: NTIS HC A03/MF A01 CSCL 20/4

A one dimensional model of the boundary layer (HFLUX) developed at Penn State by Carlson and Boland to simulate the behavior of the ground temperature over complex terrain has been modified by The Aerospace Corporation for use in several field experiments that require the accurate prediction of the surface radiometric temperature as a function of surface (thermal inertia, albedo, and moisture availability) and meteorological (stability and wind speed) parameters. HFLUX has demonstrated its utility for use with a broad class of remote thermal imaging problems. The physical principles upon which the model is structured, a discussion of recent work with the Aerospace model, and future developmental objectives are included in this report. GRA

N81-20398# National Water Well Association, Worthington, Ohio.

GROUNDWATER HEAT PUMPS: AN EXAMINATION OF HYDROGEOLOGIC, ENVIRONMENTAL, LEGAL, AND ECONOMIC FACTORS AFFECTING THEIR USE. VOLUME 2: APPENDIX D, STATE HYDROGEOLOGIC DESCRIPTIONS AND MAPS

Nov. 1980 106 p

(Contract DE-AC01-78CS-20060)

(DOE/CS-20060/5120-Vol-2) Avail: NTIS HC A06/MF A01

This appendix to the groundwater heat pump report contains hydrogeologic descriptions of the 48 conterminous United States with data on ground water quality. DOE

N81-20399# Oklahoma State Univ., Stillwater. Dept. of Mechanical Engineering.

FINNED TUBE HEAT EXCHANGERS: STATE OF THE ART FOR THE AIR SIDE

Faye C. McQuiston 1980 22 p refs Presented at the 5th Ann. Heat Pump Technol. Conf., Stillwater, Okla., 14-15 Apr. 1980

(Contract DE-AS05-76ET-20312)

(CONF-800451-3) Avail: NTIS HC A02/MF A01

The findings of various investigators during the past ten years greatly enhanced our ability to analyze, model, design, and optimize the finned tube heat exchangers so widely used in the HVAC business. The effect of rows, fin pitch, and other geometric parameters are now well understood and generalized heat transfer correlations are available. The relation between heat and mass transfer is much better defined and good correlation were developed. Some advances were also made in modeling techniques especially where partially dry cooling and dehumidifying coils are involved. All of these factors are reviewed to concisely summarize what is now available to the heat exchanger analyst. DOE

N81-20400# Lehigh Univ., Bethlehem, Pa. Dept. of Metallurgy and Materials Engineering.

UPPER-BOUND SOLUTIONS TO FLOW THROUGH CONICAL CONVERGING DIES

B. Avitzur, C. Narayan, and Y. T. Chou Sep. 1980 43 p refs

(Contract DE-AC02-79ER-10367)

(DOE/ER-10367/T3) Avail: NTIS HC A03/MF A01

Some upper bound solutions that describe flow through conical converging dies are reviewed. The concept of a trapezoidal field is introduced and the power requirements based on the trapezoidal field are calculated. Results are compared with those obtained using spherical and triangular fields. The relative stress expression has been developed analytically and the final optimization with respect to the pseudoin-dependent parameter is done numerically. The trapezoidal field predicts a lower upper ground solution for small semicone angles. The range over which the trapezoidal field solution becomes dominant increases with increasing friction factor. DOE

N81-20401# California Univ., Livermore. Lawrence Livermore Lab.

TRANSIENT BOUNDARY-LAYER FLOWS IN COMBUSTION ENVIRONMENTS

S. W. Kang and J. L. Levatin Nov. 1980 8 p refs Presented at the 19th Aerospace Sci. Meeting, St. Louis, Mo., 12-15 Jan. 1981

(Contract W-7405-eng-48; ARO-15812-MS)

(UCRL-84519; CONF-810106-2) Avail: NTIS HC A02/MF A01

Unsteady boundary layer flow equations characterizing hot, burning environments are solved numerically by means of a factored ADI method under transient and/or streamwise varying core flow conditions. Calculated results for compressible, turbulent flow cases show that high heat fluxes at the wall due to turbulence and changing edge conditions may bring about severe temperature increase at the wall, causing melting and hence erosion of the surface itself. DOE

N81-20402# Sandia Labs., Albuquerque, N. Mex. Fluid Mechanics and Heat Transfer Div.

MARIAH: A FINITE ELEMENT COMPUTER PROGRAM FOR INCOMPRESSIBLE POROUS FLOW PROBLEMS

David K. Gartling and Charles E. Hickox Aug. 1980 97 p refs

(Contract DE-AC04-76DP-00789)

(SAND-79-1623) Avail: NTIS HC A05/MF A01

MARIAH is a finite element computer program designed for the solution of two dimensional incompressible flows in a porous media, including the effects of heat transfer. The program capabilities and complete user instructions are presented. Several example problems are described in detail to demonstrate the use of the program. DOE

N81-20403# California Univ., Berkeley. Earthquake Engineering Research Center.

A GREEN-FUNCTION METHOD FOR WAVE INTERACTION WITH A SUBMERGED BODY

Wataru Kioka Apr. 1980 144 p refs

(Grant NSF PFR-77-20667)

(PB81-122269; UCB/EERC-80/11; NSF/RA-800197) Avail: NTIS HC A07/MF A01 CSCL 20D

A numerical method for solving boundary-value problems related to potential flows with a free surface is presented. The method determines the hydrodynamic forces exerted on a rigid body oscillating in its six degrees of freedom under a free surface as well as the forces resulting from the wave interaction of the body held fixed. The linearized problem is first formulated for a three-dimensional body of general shape in water of finite depth. Application of Green's third identify, using the Green function that satisfies the free-surface, bottom and radiation conditions, reduces the problem to the solution of an integral equation with the unknown function being the velocity potential over the body surface. An approximate Green function which is valid for the case of a relatively deep water is also presented. GRA

N81-20404# California Univ., Berkeley. Earthquake Engineering Research Center.

HYDRODYNAMIC PRESSURE AND ADDED MASS FOR AXISYMMETRIC BODIES

Fukij Nilrat May 1980 174 p refs Prepared in cooperation with California Univ., San Diego, La Jolla.

(Contract NOAA-04-6-158-44110)

(PB81-122343; UCB/EERC-80/12) Avail: NTIS HC A08/MF A01 CSCL 20D

A finite element method for determining the hydrodynamic pressure distribution on rigid axisymmetric bodies oscillating in a fluid is presented. The bodies considered are symmetric about a vertical axis; and they can either totally or partially submerged. A transmitting boundary is used to truncate the horizontal unbounded fluid domain. The formulation of added masses in the equations of motion of rigid bodies in fluid is presented. A computer program is developed which calculates pressure distributions and added masses for axisymmetric bodies oscillating at a specified frequency in the horizontal, vertical and rotational directions. The effects of compressibility of fluid and surface waves generated by oscillating bodies are also studied. Surface waves are found to have an effect on the added mass and hydrodynamic damping at low frequency while compressibility of the fluid has a significant effect at high frequency for cases involving large fluid depths. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources.* For related information see also *06 Aircraft Instrumentation,* and *19 Spacecraft Instrumentation.*

N81-20405*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

PHASE CONTROL DURING RECONSTRUCTION OF HOLOGRAPHICALLY RECORDED FLOW FIELDS USING REAL-TIME HOLOGRAPHIC INTERFEROMETRY

A. W. Burner and W. K. Goad Mar. 1981 8 p refs

(NASA-TM-81953; L-14327) Avail: NTIS HC A02/MF A01 CSCL 14E

A technique of phase control during reconstruction of holographic interferograms is demonstrated in which the recorded scene beam with disturbance present is made to interfere with the real-time scene beam after the disturbance is removed. The reference phase is adjusted during reconstruction by manipulating either the scene or reference beams. Comparisons are made between the present technique and the two-reference-beam and two-plate techniques, more commonly used for phase control during reconstruction of holographic interferograms for flow visualization. Author

N81-20406*# Southwest Research Inst., San Antonio, Tex.
THIN FILM STRAIN TRANSDUCER Final Report
James L. Rand Jan. 1981 44 p refs
(Contract NAS6-3077)
(NASA-CR-156875) Avail: NTIS HC A05/MF A01 CSCL 14B

Previous attempts to develop an appropriate sensor for measuring the stress or strain of high altitude balloons during flight are reviewed as well as the various conditions that must be met by such a device. The design, development and calibration of a transducer which promises to satisfy the necessary design constraints are described. The thin film strain transducer has a low effective modulus so as not to interfere with the strain that would naturally occur in the balloon. In addition, the transducer has a high sensitivity to longitudinal strain (7.216 mV/V/unit strain) which is constant for all temperature from room temperature to -80 C and all strains from 5 percent compression to 10 percent tensile strain. At the same time, the sensor is relatively insensitive (0.27 percent) to transverse forces. The device has a standard 350 ohm impedance which is compatible with available bridge balance, amplification and telemetry instrumentation now available for balloon flight. Recommendations are included for improved coatings to provide passive thermal control as well as model, tethered and full scale flight testing. A.R.H.

N81-20407# Naval Research Lab., Washington, D. C.
A QUANTITATIVE SCHLIEREN SYSTEM FOR MEASURING RADIAL DENSITY PROFILES OF REDUCED DENSITY CHANNELS IN GASES Interim Report
M. Raleigh and J. R. Greig 12 Feb. 1981 27 p refs
(Contract N60921-80-WR-W0189; ARPA Order 3718; RR0110941)
(AD-A095295; NRL-MR-4390) Avail: NTIS HC A03/MF A01 CSCL 20/4

A quantitative Schlieren system used to measure the radial density profiles of reduced density channels in gases is described. The system uses a simple, single path optical train and does not require a coherent light source. The cylindrical symmetry of the channels permits an Abel-like inversion of the path integrated bending of the light to yield the radial density profile. The inversion algorithm and a program using it are given and some experimental results are shown. GRA

N81-20408# Ballistic Research Labs., Aberdeen Proving Ground, Md.
MEASUREMENT OF THE LINE REVERSAL TEMPERATURE OF OH IN CH4/N2 O FLAMES
William R. Anderson Jan. 1981 27 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A095349; AD-E430563; ARBRL-TR-02280) Avail: NTIS HC A03/MF A01 CSCL 14/2

The reversal technique is universally accepted by the combustion community as an accurate method for flame-temperature measurements. This technique has generally involved the use of Na seeded in flames. However, for many burner types seeding is difficult. This work describes band-reversal measurements using OH, which occurs naturally in all flames containing oxygen and hydrogen. The theory is discussed as well as use of the technique in the burnt gas region of CH4/N2O flames. The experimental results are compared with laser-excited fluorescence temperature measurements also performed in this laboratory. Excellent agreement was achieved. GRA

N81-20409# California Univ., Livermore. Lawrence Livermore Lab.
FAST DETONATOR-ACTIVATED BALL SHUTTER FOR HIGH EXPLOSIVE EXPERIMENTS
R. A. McWilliams and William G. VonHolle 19 Sep. 1980 7 p
(Contract W-7405-eng-48)
(UCID-18814) Avail: NTIS HC A02/MF A01

A detonator-activated ball shutter was developed to protect the quartz windows in a 10 gm shot chamber used for optical-laser experiments on detonating high explosives. DOE

N81-20410# Princeton Univ., N. J. Dept. of Physics.
RESULTS ON THE PERFORMANCE OF A BROAD HAND FOCUSING CHERENKOV COUNTER
R. Cester (Torino Univ., Italy), V. L. Fitch, A. Montag, S. Sherman (California Institute of Technology, Pasadena, Calif.), R. C. Webb (Texas A&M Univ., College Station), and M. W. Witherall 1980 14 p refs Presented at the IEEE Nucl. Sci. Symp., Orlando, Fla., 5 Nov. 1980
(Contract DE-AC02-76ER-03072)
(COO-3072-119; CONF-801103-49) Avail: NTIS HC A02/MF A01

A method of Cherenkov ring imaging for a counter with large momentum and angular acceptance using standard photo multipliers was developed and applied to the design of a set of Cherenkov counters for use in a particle search experiment at Fermi National Accelerator Laboratory (FNAL). This new detector operates over the range 0.998 < (BETA) < 1.000 in velocity with a delta (BETA) approx. 2 x 10(-4). The acceptance in angle is + or - 14 mrad in the horizontal and + or - 28 mrad in the vertical. The performance of this counter is assessed. DOE

N81-20411# Bristol Univ. (England). Dept. of Aeronautical Engineering.
A FEASIBILITY STUDY OF AN INSTRUMENT FOR MEASURING WIND SPEED EMPLOYING VORTEX SHEDDING B.S. Thesis
N. R. Scobie and R. J. Snow Jun. 1980 45 p refs
(BU-254) Avail: NTIS HC A03/MF A01

An anemometer with no moving parts, which relies on the relationship between windspeed and the rate of vortex shedding from a bluff body, is described. Vortex shedding was detected in wind tunnel tests, and its frequency measured using a hot film probe attached to the rear face of the body. A comparison between various shapes of body was made over a Reynolds number range from 6,160 to 20,500. The results show that the best of the shapes studied is a triangular prism with 30 deg apex and 9 mm base. Yaw sensitivity and the effect of one design of cowl are discussed. The instrument is found to the very sensitive to yaw and mounting rigidly. Accurate results require 30 sec averaging on a spectrum analyzer. Author (ESA)

N81-20412# National Bureau of Standards, Washington, D.C.
ULTRASONIC MATERIALS CHARACTERIZATION Final Report
Harold Berger Nov. 1980 649 p refs Proceedings of the First Intern. Symp., Gaithersburg, Md., 7-9 Jun. 1978
(PB81-124984; NBS/SP-596; LC-80-600148) Avail: NTIS HC A99/MF A01 CSCL 14/4

Nondestructive testing involves a search for flaws in materials or structures; it is appreciated that voids, cracks, inclusions, and similar flaws can lead to failure. Once a flaw has been detected, it is natural to consider methods that will give more information. What is the flaw size, type, location, or orientation? It is recognized that parameters such as hardness, grain size, bonding, and residual stress can have a strong influence on material performance. The use of ultrasonic nondestructive testing to characterize materials both in terms of properties and flaws is described. GRA

N81-20811# Etablissement Technique Central de l'Armement, Arcueil (France). Lab. de Traitement d'Images.
ASSISTANCE IN INTERPRETING SATELLITE MULTISPECTRAL IMAGERY [AIDE A L'INTERPRETATION EN IMAGERIE SATELLITE MULTISPECTRALE]
M. Rebuffet *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 13 p In FRENCH
(For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

N81-20814# Forschungsinstitut fuer Informationsverarbeitung, Karlsruhe (West Germany).
SEMI-AUTOMATIC AND AUTOMATIC EXTRACTION OF OBJECTS FROM AERIAL IMAGES
W. Kestner and M. Sties *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 13 p refs (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

N81-20020# National Transportation Safety Board, Washington, D. C. Bureau of Technology.
A TECHNIQUE FOR RECOVERING NONSYNCHRONIZED DATA FROM A DIGITAL FLIGHT DATA RECORDER
Carol A. Roberts *In* DFVLR On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 323-351 refs (For primary document see N81-20007 11-01)
Avail: NTIS HC A16/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.

N81-20413 Michigan State Univ., East Lansing.
A THEORETICAL ASSESSMENT OF VIBRATIONAL TO ROTATIONAL ENERGY EXCHANGE IN THE HYDROGEN FLUORIDE CHEMICAL LASER Ph.D. Thesis
Robert Clinton Brown 1980 157 p
Avail: Univ. Microfilms Order No. 8106469

Computer models for the H2 + F2 chain reaction laser oscillator and laser amplifier are developed. Both models include comprehensive formulations of chemical reaction kinetics important to the HF laser. The models employ vibrational to rotational (VR) energy transfer and rotational nonequilibrium in an attempt to explain experimental observations of rotational lasing and P-branch lasing from high J states. Vibrational to rotational energy exchange is found important for the prediction of rotational lasing. The effect of rotational lasing was found to be kinetically similar to rotational relaxation. The effectiveness of the VR mechanism populating high rotational states is strongly dependent on its relative contribution to the total kinetic rate. The effect of different partitions between VT and VR in the VR,T mechanism was considered. Dissert. Abstr.

N81-20414# Arizona Univ., Tucson. Optical Sciences Center.
STUDY OF CHEMICAL REACTIONS AND ENERGY TRANSFER FOR HIGH-ENERGY AND HIGH-POWER LASERS Final Technical Report, 1 Jul. 1979 - 31 Aug. 1980
Marlan O. Scully 31 Oct. 1980 35 p refs
(Grant AF-AFOSR-0122-79; AF Proj. 2301)
(AD-A095706; AFOSR-81-1008TR) Avail: NTIS HC A03/MF A01 CSCL 20/5

The purpose of this project was to perform theoretical and experimental investigation on reactive and nonreactive collision processes that occur in chemical laser systems. The theoretical investigation was focused on developing reliable and tractable numerical techniques that describe the dynamics of the collision processes. The experimental effort was devoted to a chemical laser scheme based on gas phase chemiluminescence reactions that allows pre-mixing of the reagents. GRA

N81-20415# Naval Research Lab., Washington, D. C. Experimental Plasma Physics Branch.
LASER-INITIATED, REDUCED DENSITY CHANNELS FOR TRANSPORTING CHARGED PARTICLE BEAMS Interim Report
M. Raleigh, J. R. Greig, R. E. Pechacek, and E. Laikin 13 Feb. 1981 34 p refs
(Contract N60921-80-WR-W0189; ARPA Order 3718)
(AD-A095725; NRL-MR-4380) Avail: NTIS HC A03/MF A01 CSCL 20/5

A charge particle beam driven inertial confinement fusion reactor will require reduced density current carrying channels through the gas blanket to transport the beams from the diodes to the target. We have created suitable reduced density channels in air at atmospheric pressure by guiding an electric discharge with laser-induced, aerosol-initiated air-breakdown. The resulting channel, which is no longer current carrying, stabilizes about 30 microsec after the electric discharge at a radius of about 1 cm, a temperature of about 5000 K, a gas density of about 10 to the 18th power/cu cm and an electron density of about 10 to the 14th power/cu cm. After about 100 microsec, the channel becomes turbulent and expands further. We provide estimates of the diminishing temperature and increasing density during this later phase. The desired reduced-density, current carrying channel can be produced by a second fast rising, high current discharge on the described channel, after the stable reduced density conditions have been achieved. GRA

N81-20416# Naval Research Lab., Washington, D. C. Laser Plasma Branch.
EVIDENCE FOR SELF-FOCUSING OR FILAMENTATION FROM X-RAY, 3/2 OMEGA 0, AND 2 OMEGA 0 EMISSION Interim Report
M. J. Herbst, J. A. Stamper, R. R. Whitlock, R. H. Lehmberg, and B. H. Ripin 5 Feb. 1981 16 p refs
(AD-A095450; NRL-MR-4434) Avail: NTIS HC A02/MF A01 CSCL 20/6

With long pulse, moderate intensity Nd-laser irradiation of flat targets, time-integrated images of emission reveal filaments along the laser axis. Combined with fine-scale structure found in time-integrated images of X-ray emission, these filaments suggest self-focusing of hot spots in the incident beam. GRA

N81-20417# Naval Research Lab., Washington, D. C. Laser Plasma Branch.
ANOMALOUS VISIBLE EMISSION OBSERVED FROM THE REAR SIDE OF LASER IRRADIATED THIN TRANSPARENT TARGETS
S. H. Gold and E. A. McLean 3 Mar. 1981 11 p refs
(AD-A095563; NRL-MR-4463) Avail: NTIS HC A02/MF A01 CSCL 20/5

Visible emission measurements from the rear surface of laser-irradiated thin transparent target foils show a transient light flash followed by secondary light emission due to rear surface heating. This temporal signature is different from that reported in shock experiments in transparent solids. It permits rear surface temperature determinations on laser-accelerated targets to be made. GRA

N81-20418# Nichols Research Corp., Huntsville, Ala.
ATMOSPHERIC EFFECTS ON LOW-POWER LASER BEAM PROPAGATION Final Report, 15 Aug. 1978 - 15 Aug. 1979
T. W. Tuer, J. Mudar, J. R. Freeling, and G. H. Lindquist Dec. 1980 133 p refs
(Contract F33615-78-C-0627; AF Proj. 7757)
(AD-A095383; NRCAA-79-LASBR-002; SAM-TR-80-51) Avail: NTIS HC A07/MF A01 CSCL 20/5

A detailed discussion is presented of various theories, experiments, and models pertinent to atmospheric effects on the transmission of low-power laser radiation. The effects of molecules, aerosols, and turbulence and their levels in the atmosphere are considered. Specific conclusions and recommendations are given with regard to the state of knowledge in this field, and to models that can be used to predict atmospheric effects that are relevant to comprehensive personnel safety standards. GRA

N81-20419# Colorado Univ., Boulder. Joint Inst. for Lab. Astrophysics and Dept. of Chemistry.
STUDIES OF FREE RADICALS BY ULTRAVIOLET EXCIMER LASER PHOTOLYSIS Progress Report, 1 Apr. - 1 Nov. 1980
S. R. Leone 1980 12 p refs
(Contract DE-AC02-79ER-10396)
(DOE/ER-10396/2) Avail: NTIS HC A02/MF A01

An experimental technique was developed to produce and directly study vibrationally excited free radicals. Pulses of light from an ultraviolet excimer laser are used to photodissociate small molecules to generate free radicals with high internal excitation. The radicals are detected directly by the technique of time and wavelength-resolved infrared emission spectroscopy using a back-ground-limited copper-doped germanium infrared detector. A complete spectrum of the CH3 umbrella band reveals for the first time accurate positions of the vibrational progression in this band. Photofragmentation of (HC3)2Hg yielded detailed information on the vibrational distribution, rotational temperature, and deactivation rates of the CH3 stretch mode. DOE

N81-20420# Los Alamos Scientific Lab., N. Mex.
LASL FREE ELECTRON LASER EXPERIMENT
W. E. Stein, C. A. Brau, B. E. Newnam, R. W. Warren (Westinghouse Research Lab.), and J. G. Winston 1980 5 p

Presented at the 6th Conf. on the Appl. of Accelerators in Res. and Ind., Denton, Texas, 3-5 Nov. 1980 Sponsored in part by AFOSR, DARPA, and Naval Air Systems Command
(Contract W-7405-eng-36)
(LA-UR-80-3187; CONF-801111-8) Avail: NTIS HC A02/MF A01

The accomplishment of a high power, free electron laser (FEL) is dependent on efficient transfer of electron energy to the laser electromagnetic field and efficient recovery of the remaining electron energy. Electron energy transfer to the laser field occurs in a wiggler. The efficiency of energy transfer in tapered wigglers is studied and recovery of a portion of the electron energy is investigated. First, an amplifier experiment is performed to demonstrate efficient energy extraction and laser gain of a tapered wiggler. In the second experiment, the FEL amplifier is converted to an oscillator by increasing the duration of the electron beam pulse and by adding laser mirrors. In the third experiment, a racetrack beam transport system is added to the FEL oscillator to determine the recovery efficiency of the remaining electron energy. DOE

N81-20421# Princeton Univ., N. J. Plasma Physics Lab.
DIRECT NARROW LINE TUNING OF A HIGH POWER CO2 LASER
L. C. Johnson, D. K. Mansfield, and G. Taylor Jan. 1981 9 p refs
(Contract DE-AM02-76CH-03073)
(PPPL-1736) Avail: NTIS HC A02/MF A01

The operation of a high power, narrow linewidth CO2 laser suitable for application as a pump for pulsed submillimeter lasers is reported. Grating tuning and single mode CW injection were employed in an unstable ring resonator which produces 100 nsec duration, 200 to 400 Joule pulses on the 9R(22) line with a bandwidth of less than 20 MHz. DOE

N81-20422# Stuttgart Univ. (West Germany). Physikalisches Inst.
OPTICAL GAIN IN SEMICONDUCTOR LASERS Final Report
Ernst O. Goebel and Manfred H. Pilkuhn Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 100 p refs Partly in GERMAN and ENGLISH Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-167; ISSN-0340-7608) Avail: NTIS HC A05/MF A01

The amplification behavior of GaAlAs/GaAs and InP/InGaAsP double heterostructure (DHS) lasers was investigated. The line width of the optical gain spectra is shown considerably lower in DHS lasers with undoped active layers than in Si doped DHS lasers while the temperature dependence of the optical gain (threshold) as well as the maximum gain volume are quite similar in both cases. The observed wavelength dependence of the saturation of the optical gain is explained as due to the inhomogeneous carrier concentration within the active region at high photon densities. Author (ESA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N81-20423*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LIFE ANALYSIS OF MULTIROLLER PLANETARY TRACTION DRIVE
John J. Coy (Army Aviation Research and Development Command, Cleveland, Ohio), Douglas A. Rohn, and Stuart H. Loewenthal Apr. 1981 16 p refs Prepared in cooperation with Army Aviation Research and Development Command, Cleveland
(NASA-TP-1710; AVRADCOM-TR-80-C-16; E-484) Avail: NTIS HC A02/MF A01 CSCL 13I

A contact fatigue life analysis was performed for a constant ratio, Nasvytis Multiroller Traction Drive. The analysis was based on the Lundberg-Palmgren method for rolling element bearing life prediction. Life adjustment factors for materials, processing, lubrication and traction were included. The 14.7 to 1 ratio drive consisted of a single stage planetary configuration with two rows of stepped planet rollers of five rollers per row, having a roller cluster diameter of approximately 0.21 m, a width of 0.06 m and a weight of 9 kg. Drive system 10 percent life ranged from 18,800 hours at 16.6 kW (22.2 hp) and 25,000 rpm sun roller speed, to 305 hours at maximum operating conditions of 149 kw (200 hp) and 75,000 rpm sun roller speed. The effect of roller diameter and roller center location on life were determined. It was found that an optimum life geometry exists. Author

N81-20424*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPUTTERING AND ION PLATING FOR AEROSPACE APPLICATIONS
T. Spalvins 1981 14 p refs Proposed for presentation at Natl. Conf. of the Am. Electroplaters Soc., Boston, 28 Jun. - 2 Jul. 1981
(NASA-TM-81726; E-778) Avail: NTIS HC A02/MF A01 CSCL 13H

Sputtering and ion plating technologies are reviewed in terms of their potential and present uses in the aerospace industry. Sputtering offers great universality and flexibility in depositing any material or in the synthesis of new ones. The sputter deposition process has two areas of interest: thin film and fabrication technology. Thin film sputtering technology is primarily used for aerospace mechanical components to reduce friction, wear, erosion, corrosion, high temperature oxidation, diffusion and fatigue, and also to sputter-construct temperature and strain sensors for aircraft engines. Sputter fabrication is used in intricate aircraft component manufacturing. Ion plating applications are discussed in terms of the high energy evaporant flux and the high throwing power. Excellent adherence and 3 dimensional coverage are the primary attributes of this technology. Author

N81-20425*# Battelle Columbus Labs., Ohio.
TRANSFER FILM EVALUATION FOR SHUTTLE ENGINE TURBOPUMP BEARING Final Report
J. W. Kannel and K. F. Dufrane 12 Mar. 1981 23 p refs
(Contract NAS8-33576)
(NASA-CR-161672) Avail: NTIS HC A02/MF A01 CSCL 13I

A series of low speed experiments to evaluate the possible occurrence of transfer film lubrication and the effectiveness of burnished films in the shuttle spacecraft main engine thrust bearings were conducted. No evidence of transfer film lubrication was evident, although this could have been the result of the (used) condition of the bearing. Burnished films of either Teflon or Rulon were found to greatly enhance the performance of the bearing. Crush load experiments indicated that the bearing ultimate load capability is on the order of 489,000 N (110,000 pounds). The effect of ball (as well as race) burnishing techniques on bearing performance, different types of burnished films, and transfer film formation are suggested for further study. S.F.

N81-20426# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Turbomachinery Dept.
STEAM TURBINES FOR LARGE POWER OUTPUTS
1980 586 p refs Proceedings of 1980 Lecture Ser., Rhode-Saint-Genese, Belgium, 21-25 Apr. 1980
(VKI-LS-1980-6) Avail: NTIS HC A25/MF A01

A lecture series on the design and development of steam turbines was presented. Topics cover the aerodynamic design of rotating and nonrotating parts for steam turbines. Blade vibration-excitation and sound generation by flow nonuniformities are discussed. Nonequilibrium flow processes are described, and calculation of one dimensional and two dimensional condensing flows with application to the estimation of wetness loss in turbines is shown. The development of bladings for large steam turbines and field turbine tests are also addressed. For individual titles, see N81-20427 through N81-20433. Author (ESA)

N81-20427# Westinghouse Electric Corp., Philadelphia, Pa.
STEAM TURBINES FOR LARGE POWER OUTPUTS
W. G. Steltz *In* Von Karman Inst. for Fluid Dyn. Steam Turbines for Large Power Outputs 1980 70 p refs (For primary document see N81-20426 11-37)
Avail: NTIS HC A25/MF A01

An historical perspective on steam turbine development is presented, then design considerations specific to steam turbine blade paths are reviewed. Thermal to mechanical energy conversion in turbomachinery is described in terms of the force developed on the blading. The magnitude of the force developed is determined by application of Newton laws. Turbine stage designs and stage performance characteristics are given. Low pressure turbine design is also addressed, including comparison of turbine flow field solutions using the matrix and streamline curvature techniques. Physical chemistry turbine design aspects are discussed and blade to blade flow analysis techniques are summarized, emphasizing the conservation equations of mass and momentum. Author (ESA)

N81-20428# Kraftwerk Union A.G., Mulheim (West Germany).
DESIGN OF NONROTATING PARTS
H. Keller *In* Von Karman Inst. for Fluid Dyn. Steam Turbines for Large Power Outputs 1980 79 p refs (For primary document see N81-20426 11-37)
Avail: NTIS HC A25/MF A01

The design of nonrotating passages in steam turbines is discussed. The quantitative influence on heat rate of different losses in steam turbines are shown, and computational techniques are reviewed. Turbine inlet design is then studied and the state of the art is described. Turbine outlet design is next covered and possible improvements in flow performance are identified. Turbine valve design as well as interconnecting pipework and armatures are also considered for cost effective optimization.
Author (ESA)

N81-20429# Brown, Boverie und Cie, A.G. Baden (Switzerland).
BLADE VIBRATION EXCITATION AND SOUND GENERATION BY FLOW NONUNIFORMITIES
H. Bloemhof *In* Von Karman Inst. for Fluid Dyn. Steam Turbines for Large Power Outputs 1980 77 p refs (For primary document see N81-20426 11-37)
Avail: NTIS HC A25/MF A01

Basic relationships between blade vibration excitation and sound generation are discussed. Information is presented about the generation and behavior of viscous wakes of blades, struts, etc., which are responsible for turbine noise in many cases. A theoretical model for calculating resonance stress amplitudes of a vibrating blade is also presented. It is shown that exact information about blade vibration mode and about the distribution of the exciting forces is necessary for an accurate calculation of these resonance stress amplitudes. If these data are not well known, substantial simplifications must be made. Principal considerations on sound generation by a moving blade row in the absence or presence of a row of vanes are discussed. Specifically, cut off effects are explained which make it possible to reduce sound generation, due to rotor-stator interaction, by choosing an adequate blade number ratio. Author (ESA)

N81-20430# Birmingham Univ. (England).
NONEQUILIBRIUM EFFECTS IN WET-STEAM TURBINES
J. B. Young and F. Bakhtar *In* Von Karman Inst. For Fluid Dyn. Steam Turbines for Large Power Outputs 1980 197 p refs Sponsored by UK Science Research Council (For primary document see N81-20426 11-37)
Avail: NTIS HC A25/MF A01

The theories associated with the properties of steam, nucleation and droplet growth are summarized. A rapid and accurate integral technique for computing one dimensional wet-steam flows is presented, and application to the prediction of condensation shocks in supersonic nozzles is shown. Thermodynamic losses in flowing steam are examined and flow equations are developed. Application to turbines is considered and test data are analyzed. Results are extended to two dimensional blade to blade flows with phase change. The analysis indicates, within the limitations of the small amount of experimental observations available, that two dimensional flows of nucleating and wet steam in nozzles can be treated satisfactorily by a time marching technique. Author (ESA)

N81-20431# Westinghouse Electric Corp., Philadelphia, Pa.
FIELD TURBINE TESTS
N. R. Deming *In* Von Karman Inst. for Fluid Dyn. Steam Turbines for Large Power Outputs 1980 45 p refs (For primary document see N81-20426 11-37)
Avail: NTIS HC A25/MF A01

The problems of field testing, from the initial planning stage through the running of the tests and the analysis of the results, are addressed. Emphasis is on obtaining information about the overall performance of the unit and a breakdown into its component performances for more direct comparison with predictions. Flow measurement test codes are reviewed. Selection and installation of instruments is discussed and a data acquisition system is described. Processing test data is also considered.
Author (ESA)

N81-20432# Ansaldo S.p.A., Genoa (Italy). Fluid Dynamics Lab.
FLOW IN A 320 MW LOW-PRESSURE SECTION: THEORETICAL AND EXPERIMENTAL EVALUATION
A. Accornero, G. Doria, L. Maretto, and E. Zunino *In* Von Karman Inst. for Fluid Dyn. Steam Turbines for Large Power Outputs 1980 32 p refs (For primary document see N81-20426 11-37)
Avail: NTIS HC A25/MF A01

Results of tests carried out on a 320 MW low pressure cylinder were used to check the confidence level of a through-flow computer program in predicting turbine behavior with respect to flow configurations. The test turbine is described along with the turbine setup for flow measurements, the plant setup for cycle measurements, the instrumentation, and the data acquisition and control system. The procedure is outlined, and the data reduction procedure is given. Through flow calculation is considered, and the results are compared with calculations. The agreement in total and static pressure distributions is satisfactory.
Author (ESA)

N81-20433# GEC Turbine Generators Ltd., Manchester (England).
EXPERIMENTAL DEVELOPMENT OF BLADINGS FOR LARGE STEAM TURBINES
H. J. A. Cox *In* Von Karman Inst. for Fluid Dyn. Steam Turbines for Large Power Outputs 1980 81 p refs (For primary document see N81-20426 11-37)
Avail: NTIS HC A25/MF A01

Experimental aerodynamic development techniques are reviewed. Blading for stages in the high pressure and the intermediate pressure cylinders are treated together, while blading for most stages in the low pressure cylinder must be studied separately due to differing flow regime requirements. Flow tests which provide measurement data for design and performance assessment, and provide a means of optimizing blade profile designs, are considered. Average velocity and angle measurement, unsteady pressure measurement, and turbulence as well as flow unsteadiness metering are discussed. Instrumentation for measurements in wet steam is described. The development of both blading types is summarized with respect to application. The development of long blading in the low pressure case is emphasized. Author (ESA)

N81-20434# United Technologies Corp., South Windsor, Conn. Power Systems Div.
HIGH-RELIABILITY GAS TURBINE COMBINED-CYCLE DEVELOPMENT PROGRAM, PHASE 1. VOLUME 2: APPENDIXES Interim Report
F. H. Boenig and J. H. Lewis Oct. 1980 124 p refs Sponsored by Electric Power Research Inst.
(EPRI Proj. 1187-1)
(EPRI-AP-1599-Vol-2) Avail: NTIS HC A06/MF A01

Results are presented of Phase 1 of a multiphase program leading to the development of a High Reliability Gas Turbine. The engine would be used for the base load, combined cycle application starting in the mid-1980's. The design, with primary emphasis on reliability, recognizes the need on the part of the electric utility user for high operating availability together with low maintenance cost to take full advantage of the capital cost and efficiency advantage offered by the combined cycle plant. Phase 1 was a conceptual design study of both the gas turbine itself and the full plant. Component designs for the gas turbine were selected on the basis of a review of past operational experience and an in-depth statistical reliability analysis. Reliability in the auxiliary and balance of plant waste heat recovery equipment was provided by redundancy of critical components as well as the use of proven equipment. DOE

N81-20435# SKF Industries, Inc., King of Prussia, Pa.
DRY LUBRICATION OF HIGH TEMPERATURE SILICON NITRIDE ROLLING CONTACTS Final Report, 12 Sep. 1979 - 12 Sep. 1980
T. M. Yonushonis Nov. 1980 95 p refs
(Contract N00019-79-C-0612)
(AD-A095202; SKF-AT80C040) Avail: NTIS HC A05/MF A01 CSCL 13/9

Successful solid lubrication of silicon nitride has been demonstrated at high temperature. Rolling contact four ball tests were used to simulate bearing operation. Solid lubrication films were transferred to the silicon nitride balls from graphite cages. Long term tests at a 1000 F (538 C) produced very low silicon nitride wear rates. Optimum performance was achieved using a cage designed by SKF Industries, Inc. and manufactured from Pure Carbon Co. P2003 graphite. Other solid lubricant systems were evaluated, but were not as effective as the P2003 graphite transfer film lubrication in preventing silicon nitride wear. Favorable four ball test results indicate feasibility of silicon nitride bearings for high temperature turbine applications. GRA

N81-20436# Sonobond Corp., Westchester, Pa.
ULTRASONIC WELD SEALING OF M55 STAB DETONATORS Final Report, Sep. 1978 - Aug. 1980
Philip C. Krause and Paul Montelione Jan. 1981 65 p refs
(Contract DAAK10-78-C-0430)
(AD-A095343; AD-E400517; RR-80-4; ARLCD-CR-80051) Avail: NTIS HC A04/MF A01 CSCL 19/1

Ultrasonic ring welding was investigated as a means for hermetically sealing the M55 detonator, in an effort to find a more economical, less labor-intensive method of sealing. The current method utilizes the manual application of lacquer for sealing, which is tedious, subject to non-uniformity and requires a separate work station. Ultrasonic welding did not provide reproducible leak-tight welds because of the lack of rigid support in the detonator configuration for adequate clamping force application during welding. An alternative which would offer a higher probability of success, would be to alter the detonator configuration to provide an outside flange on the cup, so that the cover disc can be welded t o the flange. In this configuration, a solid anvil can support the flange thereby enabling the application of a suitable clamping force. GRA

N81-20437# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
HIGH SPEED CYLINDRICAL ROLLER BEARING DEVELOPMENT Final Report, 15 Sep. 1977 - 29 Feb. 1980
Paul F. Brown, Louis J. Dobek, and Edward J. Tobiasz Aug. 1980 72 p refs
(Contract F33615-77-C-3114; AF Proj. 3048)
(AD-A095357; PWA-FR-12598; AFWAL-TR-80-2072) Avail: NTIS HC A04/MF A01 CSCL 13/9

High speed experimental tests provided data on six parametric cylindrical roller bearings. Four bearing variables were evaluated and the results were correlated with the analytical model developed under Naval Air Propulsion Center Contract N00140-76-C-0383 with support form the Air Force Aero Propulsion Laboratory MIPRFY14557600623. Roller end clearance was found to have a significant effect on roller end and guide flange wear, whereas the variables roller end circular runout and inner ring guide flange height were both observed to have a moderate effect on water. GRA

N81-20438# Westinghouse Electric Corp., Philadelphia, Pa.
DETECTION OF WATER INDUCTION IN STEAM TURBINES Final Report
R. P. Benedict, J. W. Wonn, M. C. Luongo, and J. S. Wyler Nov. 1980 59 p refs
(EPRI-CS-1604) Avail: NTIS HC A04/MF A01

Several ultrasonic sensing systems with thermocouple and pressure systems were compared for their response to the presence of water in steam pipes. Water was purposely introduced into pipes in laboratory controlled situations which included static backup and the two-phase regimes of film, slug, particle, and chunk flows. All data were preserved on magnetic tape for subsequent analysis. All sensing methods were found to be responsive to all types of steam/water inducation, with the ultrasonic instrumentation believed to show advantages because of its rapid response and its noninstrusive nature. DOE

N81-20439# Sandia Labs., Albuquerque, N. Mex.
INSERT TYPE MILLING CUTTER EVALUATION
J. F. Gonzales 1980 7 p refs Presented at IMOG Machine Tool Subgroup Meeting, Livermore, Calif., 7-8 Oct. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-2185C; CONF-8010120) Avail: NTIS HC A02/MF A01

Data on the major manufacturers of Insert Type Milling Cutters was obtained. Each manufacturers' respresentative was contacted and informed of the pending test. They were told the type of material to be machined and the parameters of the operation. The manufacturers were asked to supply us with a cutter and inserts; they recommended to meet our needs for machining 304 stainless steel as specified in the Machining Data Handbook. Only three manufacturers responded; Carboloy, Kenna-metal, and Valenite. Cutters from each were tested. Each cutter was exposed to the exact same conditions, varying only where the cutter parameters dictated, to assure equality. The test results show that the Valenite cutter and inserts would require the least amount of maintenance, the greatest amount of wear life, and the best finishes. This cutter also required the least amount of horsepower in each cut. DOE

N81-20440# General Electric Co., Schenectady, N. Y. Gas Turbine Div.
DEVELOPMENT OF HIGH-TEMPERATURE TURBINE SUBSYSTEM TECHNOLOGY TO A TECHNOLOGY READINESS STATUS, PHASE 2 Quarterly Report, Jul. - Sep. 1980
M. W. Horner Oct. 1980 89 p
(Contracts DE-AC01-76ET-1034; EX-76-C-01-1806)
(FE-1806-96) Avail: NTIS HC A05/MF A01

Progress is reported in the design, development and testing of a high-temperature gas turbine for use in a combined-cycle power plant, with coal-derived fuel, at a firing temperature of 2600 F and with growth capability to 3000 F. Topics covered include hot gas path development test; turbine simulation tests; shock tunnel tests; low-temperature, low Btu gas cleanup system tests; aerodynamics tests; motorized rig tests; and air turbine tests. An update of gas-fueled and liquid-fueled combined power plant design is included. DOE

N81-20441# Cyclomatic Industries, Inc., San Diego, Calif.
HIGHLY EFFICIENT WELDING POWER SUPPLY Final Report, 1 May 1978 - 30 Sep. 1980
James M. Thommes Sep. 1980 99 p refs
(Contracts DE-AC03-78CS-40023; EM-78-C-03-1837)
(DOE/CS-40023/T1) ;Avail: NTIS HC A05/MF A01

The results and findings of an energy efficient welding power source development project are reported. The power source developed is to be used for electric arc welding processes in which 3.5 trillion Btu of energy can be saved annually. The power source development incorporates the use of switch mode power supply techniques in order to convert industrial supply mains (230/460 VAC 3 phi 60 Hz) to appropriate welding voltages and currents (up to 32 volts/up to 300 amps). A series capacitor switch mode power circuit was the circuit technique chosen in order to optimize energy efficiency, costs, reliability, size/weight, and welding performance. Test results demonstrated an effective efficiency of 80% to 91% for the energy efficient power source while the conventional types of power sources tested ranged 41% to 74% efficiency. DOE

N81-20442# Rolls-Royce Ltd., Derby (England).
THE BURR MUST GO
A. Bowers 1980 6 p Transl. into ENGLISH from Oberflaeche (West Germany), v. 4, 1979
(PNR-90042; Trans-15258) Avail: NTIS HC A02/MF A01

The mechanical removal of burrs, casting seams and coupons, from metals and plastics in a production environment is discussed. Grinding techniques using hand-held tools, milling cutters or angular grinding machines are mentioned with the appropriate grinding pins and abrasive wheels. Precision deburring and chamfering using contour milling machines and belt grinders are discussed. Vibratory grinding, blasting and use of rotating brushes

are shown useful for deburring with small loss of material. Names of equipment manufacturers are provided throughout.
Author (ESA)

N81-20443# Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany). Abteilung Fertigungsverfahrensentwicklung.
WELDING OF NICKEL ALLOYS Final Report
Peter Adam Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 60 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-180; ISSN-0340-7608) Avail: NTIS HC A04/MF A01

In relation to the manufacturing of jet engine parts, various alloys along with different conventional and nonconventional welding techniques were considered. Weld strength was determined by destructive testing. Photomicrography was used to reveal weld grain structure. microcrack formation and weld geometry in rotating parts were also studied. Results are seen as applicable to the validation and qualification of specific weld techniques for defined engine part configuration. Sample results given are for electron beam welding and for friction welding of Inconel 718 with waspalay as well as for diffusion welding of Ti6Al4V with cost In 100. Author (ESA)

N81-20444# Centre National d'Etudes Spatiales, Toulouse (France). Dept. Stabilisation Structure Thermique.
MAGNETIC BEARING REACTION WHEEL TESTS
L. Torres 6 Jun. 1980 25 p In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-699)
(CNES-80/CT/PRT/SST/SS/162) Avail: NTIS HC A02/MF A01

Torque measurements on a scale model of a SPOT satellite type, three axis stabilization reaction wheel were made. The sensing scheme of the command electronics and calibration of the tachometer are described. Counter-rotation torque is measured off the wheel axis of rotation. Characterization of the wheel bearings is emphasized. The magnetic bearing field configuration is shown. Transversal stiffness measurement of the rotor, high speed (2700 rpm) friction torque measurement around the wheel axis of rotation, and measurement of the magnetic bearing torque at very low spin rote are depicted. Author (ESA)

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N81-20445 Columbia Univ., New York.
ON THE OPTIMAL MAINTENANCE OF RELIABILITY SYSTEMS Ph.D. Thesis
Michael Nikolay Katehakis 1980 105 p
Avail: Univ. Microfilms Order No. 8104941

The problem of determining policies for assignment of the repairmen to failed components, which are optimal with respect to either or both the average expected operation time or the expected total discounted operation time of the system criteria, is investigated. The series system which is maintained by a single repairman and whose components have exponential failure and repair distributions, is considered. The two component series system, maintained by a single repairman is studied under the assumption of exponential failure times, when the repair of each component requires the completion of several independent, identifiable repair stages, each of exponential duration. The structure of any policy which maximizes the average expected operation time of the system is determined. Dissert. Abstr.

N81-20446# Maryland Univ., College Park. Computer Vision Lab.
IMAGE RESTORATION PARAMETER CHOICE: A QUANTITATIVE GUIDE Interim Report
M. J. McDonnell Oct. 1980 20 p refs
(Grant AF-AFOSR-3271-77; AF Proj. 2304)
(AD-A095708; TR-965; AFOSR-81-0137TR) Avail: NTIS HC A02/MF A01 CSCL 05/8

Quantitative results are presented which should be useful in choosing parameters required for image restoration by Wiener filtering. These results are obtained using a single point spread function and two blurred image lines. Various measures of restored image quality are examined. GRA

N81-20447# Army Materials and Mechanics Research Center, Watertown, Mass. Materials Testing Technology Div.
COMPUTER TECHNIQUES FOR ULTRASONIC INSPECTION Final Report
James M. Smith Dec. 1980 15 p refs
(AD-A095285; AMMRC-TR-80-57) Avail: NTIS HC A02/MF A01 CSCL 14/2

This paper will describe two prototype ultrasonic inspection systems developed in-house at the Army Materials and Mechanics Research Center (AMMRC). Both systems incorporate computers for data acquisition and analysis purposes. The first inspection instrument uses a 64-element transducer array and is capable of inspecting artillery shell rotating bands for unbonds at high inspection rates (less than 10 seconds per shell). The second instrument is designed to measure the nonmetallic inclusion content in steel billets. Steel 'cleanliness' measurements are important when high quality steel is required for critical gears and bearings in aircraft engines. GRA

N81-20448# California Univ., Berkeley. Lawrence Berkeley Lab. Materials Science and Mineral Engineering Dept.
NON-DESTRUCTIVE FAILURE PREDICTION FOR BRITTLE SOLIDS
A. G. Evans Oct. 1980 21 p refs Presented at the Symp. on Irradiation Phase Stability, Pittsburgh, 4-8 Oct. 1980
(Contracts W-7405-eng-48; F33615-74-C-5180; N00014-79-C-0159)
(LBL-10341-Rev; CONF-801072-4-Rev) Avail: NTIS HC A02/MF A01

Structural design with brittle materials requires that the stress level in the component correspond to a material survival probability that exceeds the minimum survival probability permitted in that application. This is achieved by developing failure models that fully account for the probability of fracture from defects within the material (including considerations of fracture statistics, fracture mechanics and stress analysis), coupled with nondestructive techniques that determine the size of the large extreme of critical defects. Approaches for obtaining the requisite information are described. DOE

N81-20449# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
INTEGRATING RELIABILITY ANALYSIS AND DESIGN
D. M. Rasmuson Oct. 1980 68 p ref
(Contract DE-AC07-76ID-01570)
(ALO-131; EGG-IS-5187) Avail: NTIS HC A04/MF A01

The Interactive Reliability Analysis Project is described and the advantages of using computer-aided design systems (CADS) in reliability analysis are enumerated. Common cause failure problems require presentations of systems, analysis of fault trees, and evaluation of solutions to these. Results have to be communicated between the reliability analyst and the system designer. Using a computer-aided design system saves time and money in the analysis of design. Computer-aided design systems lend themselves to cable routing, valve and switch lists, pipe routing, and other component studies. DOE

N81-20450# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Dept.
EVALUATION OF NONDESTRUCTIVE INSPECTION METHODS APPLIED TO MILLED STEP-DOWN AREAS. VOLUME 1: TEXT AND TABLES
E. A. B. deGraaf and P. deRijk 29 Sep. 1978 55 p refs Sponsored by Research Branch of Directorate of Material 2 Vol.
(NLR-TR-78110-U-Vol-1) Avail: NTIS HC A04/MF A01

Fatigue cracks in 102 specimens were inspected non-destructively by means of eddy currents, ultrasonics, X-rays and penetrants. Successively the specimens were exposed to corrosion and the inspections repeated. Specimens were then opened forcefully and the fatigue nuclei were measured visually from

the fracture surface. It is found that eddy current inspection and both types of ultrasonic inspection and X-ray radiography inspection miss long cracks both before and after corrosion, especially shallow cracks. With all types of inspection there exists a clear tendency to miss cracks under a certain threshold level of crack depth. Also sensitivity and reliability are seen to decrease significantly due to exposure to corrosion. A long and shallow crack is shown to have more chance to escape detection than a short but deep one. Ultrasound echo amplitude as on estimation of crack size has no practical value in the present situation.
Author (ESA)

N81-20451# National Aerospace Lab., Amsterdam (Netherlands).
EVALUATION OF NONDESTRUCTIVE INSPECTION METHODS APPLIED TO MILLED STEP-DOWN AREAS. VOLUME 2: FIGURES
E. A. B. deGraaf and P. deRijk 29 Sep. 1978 91 p 2 Vol. (NLR-TR-78110-U-Vol-2) Avail: NTIS HC A05/MF A01

Fatigue cracks were produced in 102 specimens. After cracking, these specimens were inspected nondestructively by means of eddy currents, ultrasonics, X-rays and penetrants. The specimens were successively exposed to corrosion and the inspections repeated. Specimens were then opened forcefully and the fatigue nuclei were measured visually from the fracture surface. All the data obtained by the various nondestructive inspections and the visual examination are presented in graphical form. It is found that eddy current inspection and both types of ultrasonic inspection and X-ray radiography inspection miss astonishingly long cracks both before and after corrosion, especially shallow cracks. With all types of inspection there exists a clear tendency to miss cracks under a certain threshold level of crack depth. Sensitivity and reliability of eddy current inspection. Both types of ultrasonic inspection, X-ray radiography and penetrant inspection are seen to decrease significantly due to exposure to corrosion.
Author (ESA)

N81-20452# Indian Lead Zinc Information Centre, New Delhi.
DEFECTS IN GALVANIZED PRODUCTS. AN INSPECTION GUIDE
Nov. 1980 40 p
(PB81-123671) Avail: NTIS HC A03/MF A01 CSCL 11C

A brief description about the various steps of the galvanizing process and the important parameters in these stages in order to produce a defect-free quality product are given. Visual and micrographic descriptions of defects, their causes, suggested remedies and some remarks aimed at assisting the customer and the inspector in understanding the import of the defect insofar as the appearance and protective function of the coating are concerned are presented. The test procedures for determining the coating weight, uniformity and adherence of the coating are described.
GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N81-20453 State Univ. of New York at Stony Brook.
TIME-AVERAGE OPTICAL METHODS FOR STRAIN ANALYSIS Ph.D. Thesis
Chao-Jui Lin 1980 106 p
Avail: Univ. Microfilms Order No. 8105919

Methods are proposed for the determinations of the in-plane displacement and out-of-plane slope of structures subjected to cyclic loading. The recording on a photographic film is done statically, with an exposure time longer than the period of vibration (time-average). The analysis and experimental demonstrations of sinusoidal in-plane vibration problems are presented by using a time average in-plane moire method and a time-average laser speckle method. Maximum amplitudes of in-plane displacements are obtained from the fringe patterns. A double-exposure reflection laser speckle method is introduced. Slope contours of a mirror-surface plate under transverse bending are obtained. The analysis and experimental demonstrations of sinusoidal out-of-plane vibration problems are also presented by using this method and the reflection moire method through the time-average approach. A general analysis of in-plane cyclic loading is presented. The fringe order for non-sinusoidal vibration is obtained.
Dissert. Abstr.

N81-20454 Michigan State Univ., East Lansing.
AN EXPERIMENTAL STUDY OF LARGE COMPRESSIVE LOADS UPON RESIDUAL STRAIN FIELDS AND THE INTERACTION BETWEEN SURFACE STRAIN FIELDS CREATED BY COLDWORKING FASTENER HOLES Ph.D. Thesis
Rajab Adaki Sulaimana 1980 234 p
Avail: Univ. Microfilms Order No. 8106448

Deductions include: (1) in plane compressive loads tend to decrease residual hoop strain parallel to the axis of applied load and to increase residual hoop strain transverse to the load axis; (2) the effects of cycling of the in-plane loads were complex, but in general increased residual hoop strain around the fastener hole boundary; (3) in-plane loads have little effect on radial strains; (4) coldworking a fastener hole or a row of holes introduces undesirable tensile strain climate at a plate edge, whereas peak compressive residual radial strains are shifted away from important areas near fastener holes; (5) a minimum effective coldwork fastener hole separation is about 2 hole diameters for a radial interference level of 6 mils: below this limit, the effect of coldworking the holes diminishes the residual compressive strain field; (6) the interaction of coldwork induced strain fields with one another and with free boundaries is quite complex.
Dissert. Abstr.

N81-20455 Virginia Polytechnic Inst. and State Univ., Blacksburg.
A GENERAL DYNAMIC SYNTHESIS FOR COMPLEX STRUCTURES COMPOSED OF SUBSTRUCTURES Ph.D. Thesis
Arthur Lynn Hale 1980 166 p
Avail: Univ. Microfilms Order No. 8105331

A general substructure synthesis method is developed for the dynamic analysis of complex flexible structures. In the synthesis method, substructures may be modeled by either distributed-parameter or discrete mathematical models. The motion of each distributed substructure is represented by a given number of substructure admissible functions. Substructure admissible functions are often low-order polynomial and hence computationally easy to work with. To represent the motion of each discrete substructure, the concept of admissible vectors is introduced. Admissible vectors represent the discrete counterpart of admissible functions for distributed substructures and they can be generated for each substructure by discretizing, i.e., sampling in space, admissible functions for a similar distributed substructure. The otherwise disjoint substructures are connected together to form a whole structure by imposing approximate geometric compatibility conditions by means of the method of weighted residuals.
Dissert. Abstr.

N81-20456 California Inst. of Tech., Pasadena.
A LINEARIZATION TECHNIQUE FOR THE DYNAMIC RESPONSE OF NONLINEAR CONTINUAE Ph.D. Thesis
Charles Morton Krousgrill, Jr. 1981 133 p
Avail: Univ. Microfilms Order No. 8105124

A technique for understanding the dynamic response of structural elements governed by nonlinear partial differential equations is developed. This technique is based on the concepts of the equivalent linearization method which relies on obtaining an optimal linear set of equations to model the original nonlinear set. The linearization is performed at the continuum level. At this level, the equivalent linear stiffness and damping parameters are physically realizable and are defined in such a way that the method is easily incorporated into finite element computer codes. Three different approaches to the method are taken with each approach based on the minimization of a distinct difference between the nonlinear system and its linear replacement. Existence and uniqueness properties of the minimization solutions are established. The method is specialized for the treatment of steady state solutions to harmonic excitation and of stationary response to random excitation. Procedures for solving the equivalent linearization are also discussed.
Dissert. Abstr.

N81-20457 Michigan State Univ., East Lansing.
BUCKLING OF A RECTANGULAR PLATE ON AN ELASTIC FOUNDATION, COMPRESSED IN TWO DIRECTIONS Ph.D. Thesis
Richard Charles Warren 1980 65 p
Avail: Univ. Microfilms Order No. 8106453

The first linear buckling mode of a rectangular elastic plate, resting on a Wrinkler foundation under various edge loading conditions was determined. Two cases of boundary conditions were considered, simply supported all around and clamped all around. The solution for the simply supported case was found in closed form, but a numerical approximation was employed for the clamped case. The results were compacted to solutions of the circular plate by Wolkowisky and to Hetenyi's solutions for beams on elastic foundations. Dissert. Abstr.

N81-20458 California Inst. of Tech., Pasadena.
A STRAIN-SPACE PLASTICITY THEORY AND NUMERICAL IMPLEMENTATION Ph.D. Thesis
Paul Jerome Yoder 1981 133 p
Avail: Univ. Microfilms Order No. 8104904

An alternate version of plasticity which closely parallels the traditional theory but interchanges the roles of stress and strain is presented. As a result, the formulation gives stress as a functional of strain, rather than the reverse, and is thus attuned to the needs of the dynamicist. In the case of a single loading surface, the two versions of plasticity are shown to be equivalent when the model parameters are appropriately selected. A similar though less satisfying result is obtained for formulations involving a plurality of loading surfaces. The strain-space formulation is coded for numerical solution, with provision for a variable number of loading surfaces. The numerical algorithm is tested for accuracy in the handling of perfect plasticity, and the results are compared with those given by three commonly used stress space algorithms. The algorithm is then interfaced with a finite element code and used to study the response of a foundation resting on an elastoplastic half space. Dissert. Abstr.

N81-20459 Georgia Inst. of Tech., Atlanta.
DYNAMIC STABILITY OF STRUCTURAL ELEMENTS SUBJECTED TO STEP LOADS Ph.D. Thesis
Constantinos Anastasios Lazopoulos 1980 186 p
Avail: Univ. Microfilms Order No. 8106073

The concept of dynamic stability of structural elements subjected to step-loads is investigated and the criteria and estimates for finding critical conditions are developed. The solution methodology is demonstrated through simple mechanical models of one and two-degree-of-freedom, and is applied to the dynamic stability analysis of shallow arches. Thus, Chapter 1 deals with the introduction to the subject of dynamic stability of structural elements. Chapter 2 presents a detailed static buckling analysis of the three models. Chapter 3 presents the concept of dynamic stability for impulsively loaded systems. Chapter 4 gives a detailed treatment of systems loaded suddenly with constant load of infinite duration. Chapter 5 extends these concepts for the case of suddenly applied loads of constant magnitude and finite duration. Chapters 6 and 7 deal with the study of the effects of static preloading and small damping on the dynamic critical conditions. Chapter 8 deals with applications to shallow arches. Dissert. Abstr.

N81-20460 Michigan Univ., Ann Arbor.
NUMERICAL PROCEDURE FOR PREDICTING THE TORSIONAL DYNAMIC RESPONSE OF SOLID MEDIA Ph.D. Thesis
Robert Henke 1980 441 p
Avail: Univ. Microfilms Order No. 8106152

A practical method of solving the equation describing the dynamic behavior of multidimensional, linear elastic and nonlinear inelastic solid media was developed. The method is capable of predicting the dynamic response of soil foundation systems subjected to loads having a broad range of intensities. Similar to the one dimensional method of characteristics, the equations of motion and derivatives of the stress-strain relationships are combined. Conditions are imposed which allow groups of partial derivatives to be replaced with total derivatives. This technique of transforming equations, which introduces no approximations, is applied to the equations describing the dynamic, axisymmetric torsional behavior of three dimensional linear elastic and nonlinear inelastic media. Dissert. Abstr.

N81-20461# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
CRITICALLY LOADED HOLE TECHNOLOGY PILOT COLLABORATIVE TEST PROGRAMME Final Technical Report
Tom Coombe and Robert B. Urzi Nov. 1980 60 p refs
(AGARD-R-678; ISBN-92-835-1375-4) Avail: NTIS HC A04/MF A01

The interaction of fastener hole quality and resulting fatigue lives of low load transfer structural joints is investigated while utilizing fatigue rated and nonfatigue rated fastener systems. These fastener systems were primarily loaded in shear. A load level verification was made and it was established that there were few differences, within the range of testing frequencies used in the accuracy of loading or comparability of data between participants. Interference fit fasteners are relatively insensitive to effects of surface finish and hole quality with the exception of dimensional tolerance which is important because it affects interference fit. Interference fit fasteners gave better results than clearance fit. S.F.

N81-20462*# General Dynamics/Convair, San Diego, Calif. Advanced Space Programs Dept.
GRAPHITE COMPOSITE TRUSS WELDING AND CAP SECTION FORMING SUBSYSTEMS. VOLUME 1: EXECUTIVE SUMMARY Final Report
31 Oct. 1980 42 p
(Contract NAS9-15973)
(NASA-CR-160933; GDC-ASP-80-007-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 20K

A rolltrusion process was developed for forming of a hybrid, single-ply woven graphite and glass fiber cloth, impregnated with a polysulfone resin and coated with TiO2 pigmented P-1700 resin into strips for the on-orbit fabrication of triangular truss segments. Ultrasonic welding in vacuum showed no identifiable effects on weld strength or resin flow characteristics. An existing bench model cap roll forming machine was modified and used to roll form caps for the prototype test truss and for column test specimens in order to test local buckling and torsional instability characteristics. A.R.H.

N81-20463*# General Dynamics/Convair, San Diego, Calif. Advanced Space Programs Dept.
GRAPHITE COMPOSITE TRUSS WELDING AND CAP SECTION FORMING SUBSYSTEMS. VOLUME 2: PROGRAM RESULTS Final Report
31 Oct. 1980 104 p refs
(Contract NAS9-15973)
(NASA-CR-160932; GDC-ASP-80-007-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 20K

The technology required to develop a beam builder which automatically fabricates long, continuous, lightweight, triangular truss members in space from graphite/thermoplastics composite materials is described. Objectives are: (1) continue the development of forming and welding methods for graphite/thermoplastic (GR/TP) composite material; (2) continue GR/TP materials technology development; and (3) fabricate and structurally test a lightweight truss segment. S.F.

N81-20464*# Lehigh Univ., Bethlehem, Pa.
APPLICATION OF THE LINE-SPRING MODEL TO A CYLINDRICAL SHELL CONTAINING A CIRCUMFERENTIAL OR AXIAL PART-THROUGH CRACK
F. Delale and F. Erdogan Apr. 1981 32 p refs
(Grant NGR-39-007-011; Contract DOT-RC-82007; Grant NSF CME-78-08737)
(NASA-CR-164058)
Avail: NTIS HC A03/MF A01 CSCL 20K

An approximate solution was obtained for a cylindrical shell containing a part-through surface crack. It was assumed that the shell contains a circumferential or axial semi-elliptic internal or external surface crack and was subjected to a uniform membrane loading or a uniform bending moment away from the crack region. A Reissner type theory was used to account for the effects of the transverse shear deformations. The stress intensity factor at the deepest penetration point of the crack was tabulated for bending and membrane loading by varying

three dimensionless length parameters of the problem formed from the shell radius, the shell thickness, the crack length, and the crack depth. The upper bounds of the stress intensity factors are provided by the results of the elasticity solution obtained from the axisymmetric crack problem for the circumferential crack, and that found from the plane strain problem for a circular ring having a radial crack for the axial crack. The line-spring model gives the expected results in comparison with the elasticity solutions. Results also compare well with the existing finite element solution of the pressurized cylinder containing an internal semi-elliptic surface crack. A.R.H.

N81-20465*# Lowell Univ., Mass.
STRUCTURAL RESPONSE AND INPUT IDENTIFICATION Final Report, Apr. 1976 - 31 Mar. 1981
G. Dudley Shepard, John C. Callahan, and John A. McElman 27 Mar. 1981 108 p refs
(Grant NsG-1295)
(NASA-CR-164079) Avail: NTIS HC A06/MF A01 CSCL 20K

Three major goals were delineated: (1) to develop a general method for determining the response of a structure to combined base and acoustic random excitation: (2) to develop parametric relationships to aid in the design of plates which are subjected to random force or random base excitation: (3) to develop a method to identify the individual acoustic and base input to a structure with only a limited number of measurement channels, when both types of excitation act simultaneously. S.F.

N81-20466# Naval Research Lab., Washington, D. C. Materials Science and Technology Branch.
NAVAL STRUCTURAL MATERIALS: REQUIREMENTS, ISSUES, AND OPPORTUNITIES
L. R. Hettche and A. I. Schindler 10 Apr. 1981 38 p refs Presented at the NATO Seminar on Advan. in Struct. Mat. in Relation to Defense Appl.
(AD-A095724; NRL-MR-4484) Avail: NTIS HC A03/MF A01 CSCL 13/3

This paper presents selective examples of requirements, issues, and opportunities associated with naval structural materials. In particular, the relationships between operational capabilities and structural material requirements are examined for the following Naval systems: future high performance ships, next generation V/STOL aircraft, and conventional ships. These systems are selected for review because of the differences in their time frames for operational deployment. Because of paper length consideration, the discussions on technical issues and R D opportunities are limited respectively to high strength marine alloys and emergent surface modification techniques of ion implantation and laser beam processing. Here the ability to control and predict an exacting trade off in engineering properties and service behavior is identified as a key technical issue in developing improved alloy systems. Moreover, ion implantation and laser beam processing offer the capability to optimize independent surface and bulk properties without the discontinuous interface of conventional coatings as well as to minimize the use of scarce or otherwise expensive materials. These discussions provide examples of structural materials development at various stages of technological maturity and therefore at various proximities from system impact. GRA

N81-20467# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
CRACK PROPAGATION IN ELECTRON BEAM WELDED Ti-6Al-4 UNDER SPECTRUM LOADING CONDITIONS
Charles E. Neu 18 Dec. 1980 28 p refs
(ZF54590001)
(AD-A095585; NADC-80202-60) Avail: NTIS HC A03/NF A01 CSCL 11/6

Center cracked panels of electron beam welded Ti-6Al-4V were tested under truncated F-14 aircraft wing fatigue spectra in an effort to simulate propagation of fatigue cracks from 'spike' flaws at weld intersect holes. Predictions of fatigue lives of F-14 wing carrythrough sections for various initial defect sizes were made using fracture mechanics methods. GRA

N81-20468# Martin Marietta Labs., Baltimore, Md.
THE DELAYED FRACTURE OF ALUMINUM ALLOYS Progress Report, 1 Jan. - 31 Dec. 1980
Joseph R. Pickens, David Venables, and John A. S. Green Jan. 1981 60 p refs
(Contract N00014-74-C-0277)
(AD-A095732; MML-TR-81-6C) Avail: NTIS HC A04/MF A01 CSCL 11/6

The fundamental mechanism of stress-corrosion cracking (SCC) has been studied for high-purity Al-Zn-Mg alloys. Earlier work at our laboratory and elsewhere established that hydrogen embrittlement is involved in the SCC mechanism. Moreover, we previously proposed that a Mg-H interaction exists that facilitates hydrogen entry into the alloy and its concentration at the grain boundary, leading to embrittlement. In the present work, we demonstrated the adverse effect of Mg in the bulk metal and in the oxide film on SCC. SCC testing of alloys whose surface oxide-films were removed so bulk composition effects could be studied, revealed that SCC susceptibility increases with increasing Mg to Zn wt% ratio. In film composition experiments, removal of the Mg-rich film that forms during heat treating, and replacing it with a Mg-free film by anodizing in tartaric acid decreased the susceptibility of an Al-Zn-Mg alloy. Moreover, susceptibility decreased with an increasing anodized-film thickness. Fractographic studies revealed that pitting corrosion initiates intergranular SCC in these alloys. GRA

N81-20469# Rensselaer Polytechnic Inst., Troy, N. Y.
FRACTURE MECHANICS AND DYNAMIC RESPONSE OF STRUCTURES Final Report
J. C. Amazigo Nov. 1980 10 p refs
(Grant DAAG29-77-G-0198)
(AD-A095272; ARO-14732.2-E) Avail: NTIS HC A02/MF A01 CSCL 20/11

A method is developed for the optimization against buckling of structures that undergo snap buckling. Simple formulae are obtained for the dependence of J integral on the angle or edge crack in an infinite strip of fully plastic material under antiplane shear. An assessment is made on the range of validity of the dominant term in the singular field solution for stationary cracks. The mathematical problems arising in the elastic-plastic crack growth problems are highlighted. GRA

N81-20470# Washington Univ., Seattle. Dept. of Mechanical Engineering.
DYNAMIC PIPING FRACTURE COUPLED WITH SYSTEM EFFECTS Annual Report
A. F. Emery, A. S. Kobayashi, and W. J. Love Dec. 1980 140 p refs
(EPRI Proj. 231-1)
(EPRI-NP-1640) Avail: NTIS HC A07/MF A01

A comparative study of stress intensity factors for surface flawed pipes and predictive models for initiation and rapid propagation of ductile circumferential cracks and the associated depressurization response in pipes is reported. DOE

N81-20471# United Kingdom Atomic Energy Authority, Risley (England). Nuclear Power Development Establishment.
LIFE PREDICTION METHODS FOR THE COMBINED CREEP-FATIGUE ENDURANCE
G. J. Lloyd and J. Wareing Sep. 1980 25 p refs
(ND-R-471(R)) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

The prediction methods available for the combined creep fatigue endurance are considered with respect to the evolution in their general development. The conventional linear damage methods which predict the total endurance at failure, are compared to emerging methods which consider in more detail, the path dependence and rate of development of failure. The problem of assessing the validity of the application of uniaxial creep fatigue and damage rules to practical circumstances of multiaxial stress strain states is also considered. DOE

N81-20472# Los Alamos Scientific Lab., N. Mex.
CATEGORY 1 STRUCTURES: SAFETY MARGIN AT ULTIMATE LOAD
C. A. Anderson 1980 12 p refs Presented at 8th Ann. Light Water Reactor Safety Meeting, Washington, D.C., 31 Oct. 1980
(Contract W-7405-eng-36)
(LA-UR-80-2858; CONF-8010124-1) Avail: NTIS

HC A02/MF A01

Test information needed to assess structural capability of Category I structural systems that are loaded beyond their design is described. The program activities are to continue the development of structural test plans, initiate design, construction and testing of small structures, continue to develop and perform analytical prediction of limit states, and to complete a US Reactor Concrete Structural Technology Report. DOE

N81-20473# Sandia Labs., Albuquerque, N. Mex.

PLASTIC ANALYSIS OF RANDOMLY DISTRIBUTED GRAINS IN A TENSILE SPECIMEN

D. S. Preece Jan. 1981 15 p refs

(Contract DE-AC04-76DP-00789)

(SAND-80-2780) Avail: NTIS HC A02/MF A01

Results of some preliminary plastic analyses of a composite tensile specimen are presented. The composite was created by randomly assigning one of three different sets of material properties to each finite element. Three different finite element sizes were used in an attempt to discover the influence of mesh fineness on the composite results. DOE

N81-20474# Rochester Univ., N. Y.

DIFFUSIONAL CREEP OF MULTICOMPONENT SYSTEMS Progress Report, 1 Feb. 1980 - 31 Jan. 1981

J. C. M. Li 1981 21 p

(Contract DE-AS02-76ER-02296)

(COO-2296-22) Avail: NTIS HC A02/MF A01

Results are reported for dislocation-crack electroplastic effects in additively colored KCl. DOE

N81-20475# Hanford Engineering Development Lab., Richland, Wash.

DEVELOPMENT OF AN IRRADIATION CREEP CORRELATION FOR 20% COLD-WORKED AISI 316 IN FUSION ENVIRONMENTS: DAFS CONTRIBUTION

D. G. Doran 1980 13 p refs

(Contract DE-AC14-76FF-02170)

(DOE/FF-02170/T58) Avail: NTIS HC A02/MF A01

Correlation was developed describing the anticipated irradiation creep behavior of 20 percent cold worked AISI 316 in fusion environments. It incorporates low temperature fast breeder and thermal reactor data to extend the existing breeder correlation to the temperature range of the proposed Fusion Energy Device. It also includes a dependence on displacement rate not currently incorporated in the corresponding breeder correlation. DOE

N81-20476# General Electric Co., Whetstone (England).

SPIDA: A SMALL PROGRAM FOR INTERACTIVE DISPLAY AND ANALYSIS

D. Bartlett Sep. 1980 337 p refs

(REL/R(79)28) Avail: NTIS HC A15/MF A01

FORTRAN programs are described for a PDP 11/70 computer which use a digitizer, plotter and graphics terminal to interactively carry out pre- and postprocessing for finite element stress analysis and finite difference heat transfer programs. Preprocessing includes mesh generation, bandwidth and/or wavefront optimization, load data preparation and geometry plotting while postprocessing includes deformation plots, evaluation of principal stresses and stress intensity, display and plotting of stress levels, temperatures or displacements in the form of contour plots, arrow plots and plotting along a surface. A four node 2D or axisymmetric mesh can be generated for a finite element stressing model, then converted automatically to a finite difference thermal model for running with heat transfer program MELTAN. Surface conductances and heat source data can also be generated for MELTAN. The temperatures produced by MELTAN are automatically reinterplated back to the finite element mesh for inclusion as part of a subsequent stress analysis. The programs are not listed. Author (ESA)

N81-20477# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Darmstadt (West Germany). Lab. fuer Betriebsfestigkeit.

DAMAGE TOLERANCE OF HYBRID STRUCTURES [SCHADENSTOLERANZ VON HYBRIDSTRUKTUREN]

H. Huth and D. Schuetz Bonn Bundesministerium der Verteidigung 1979 63 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium der Verteidigung

(BMVg-FBWT-79-27) Avail: NTIS HC A04/MF A01

Precedents are cited from the literature to show how the use of hybrid stiffening elements in a frame/stringer airframe construction can effect its damage tolerance behavior. For the crack propagation tests, an aluminum alloy sheet was reinforced so as to simulate a hybrid stiffener and/or a stiffened sheet. Two different types of fibers, two types of resin systems, and three different bonding systems were used. The crack propagation behavior of the center cracked specimens was investigated under constant amplitude loading as well as under flight by flight loading. It was compared with the behavior of an unstiffened sheet and a sheet reinforced by bonded aluminum stiffeners. Results show that: (1) crack propagation life and residual strength of many structures is improved by taking advantage of the high ultimate strength and good fatigue characteristics of bonded unidirectional graphite stiffeners; (2) a cold bonding system can be superior to hot bonding systems; and (3) the bond is the weak point of cracked hybrid structures. Author (ESA)

N81-20478# Karlsruhe Univ. (West Germany). Inst. fuer Werkstoffkunde 2.

HIGH TEMPERATURE PROPERTIES OF DIFFERENT SiC MATERIALS: CREEP BEHAVIOR Final Report

Klaus Schnuerer and Georg Grathwohl Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 39 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-79-157; ISSN-0340-7608) Avail: NTIS HC A03/MF A01

The creep behavior of different silicon carbide materials (hot pressed and Si infiltrated) was studied. The results are related to materials development and to the application of these materials at high temperature, e.g., in a gas turbine. Creep rotes were determined, using four point bending mode measurement for stresses of 100 MN/sqm to 190 MN/sqm, at 1000 to 1700 C, in air and in vacuum. Hot pressed silicon carbide shows measurable creep rotes at temperatures beyond 1400 C; for infiltrated materials, beyond 1000 C. The measured stress exponents and activation energies together with the microstructural results are applied to determine diffusion controlled creep mechanisms active over a large range of test conditions used. The enhanced oxidation before and during the creep experiments leads to a strength decrease in material with a higher impurity content. In this group of special ceramics, hot pressed silicon carbide shows the highest creep strength up to 1500 C and is comparable with reaction bonded silicon nitride. Author (ESA)

N81-20479# Royal Aircraft Establishment, Farnborough (England).

EVALUATION OF THE WEDGE CLEAVAGE TEST FOR ASSESSMENT OF DURABILITY OF ADHESIVE BONDED JOINTS

M. H. Stone and T. Peet London HMSO Jul. 1980 25 p refs

(RAE-TM-MAT-349; BR75842) Avail: NTIS HC A02/MF A01

The Boeing wedge test was applied to joints of aluminum alloy made with three adhesives differing in toughness. Bonding pretreatments, including sulfuric acid pickling, chromic acid anodizing and wet alumina grit blasing were compared for two of the adhesives, and clear differences in crack length appeared after exposure to 50 C and 96% relative humidity. Rates of crack growth were determined in both ambient and warm humid environments, and suitable times are suggested shown to affect results and should be standardized. Author (ESA)

N81-20480# Royal Aircraft Establishment, Farnborough (England).

THE EFFECTS OF REPAIR PATCHES ON THE STRESS DISTRIBUTION IN A CRACKED SHEET

G. Dowrick (Southampton Univ., England), D. J. Cartwright (Southampton Univ., England), and D. P. Rooke London HMSO Aug. 1980 18 p refs Presented at 2nd Intern. Conf. on Numerical Methods in Fracture Mech., Swansea, England, 7-11 Jul. 1980

(RAE-TR-80098; RAE-Mat-406; BR76461) Avail: NTIS

HC A02/MF A01

The effect of patch shape, attachment flexibility and patch stiffness on the stress intensity factor of a crack in a thin sheet is investigated analytically. The patch is considered to be made up of a series of strips perpendicular to the crack. Stress intensity factors and the force distribution along the crackline in the patch and along the middle and outer strip patches were determined for a rigidly attached patch of varying size and fixed stiffness, a square patch of fixed stiffness and variable attachment flexibility and finally a rigidly attached square patch of variable stiffness. The distributions of force were determined for two cracklengths, where the crack is completely under the patch and where the crack tip is ahead of the patch edge. It was shown that the effect of patch size is not very important, but attachment flexibility and patch stiffness are significant in the reduction of the stress intensity factor. Author (ESA)

N81-20481# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.

STATIC TEST OF A WING BOX STRUCTURE MADE OF COMPOSITE MATERIALS, PHASE 1 Final Report

Lennart Knutsson Nov. 1980 35 p refs

(Contract SWEDBTD-79-6009)

(FFA-TN-HU-2127) Avail: NTIS HC A04/MF A01

The load carrying structure in the wing of a light transport aircraft, (MULA), was tested in a simulated pull up flight maneuver. The structure consisted of a two beam wing box in sandwich construction. Carbon fibers and glass fibers in a vinylester resin were used in the faces and a foam plastic was used as core material. Unidirectional carbon fiber epoxy rods were used in areas subjected to high tensile or compressive loads. All composite parts were vacuum or pressure molded in large components bonded together to form the wind box structure. The fittings were made from steel and attached to the composite surfaces by bonding and bolting. Author (ESA)

N81-20482# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.

DYNAMIC TEST OF AN ARCH DAM USING A LASER LIGHT VIBRATION SENSOR

M. Corti, F. Parmigiani, and S. C. L. Botcherby (DECCA Radar Res. Labs) Sep. 1980 11 p refs Presented at 7th World Conf. on Earthquake Eng., Istanbul, 8-13 Sep. 1980

(CISE-1576) Avail: NTIS HC A02/MF A01

A laser light vibration sensor based on the Michelson interferometer principle is described. It operates with a 5 mW He-Ne laser source 200 m away from the moving target without the need of retro-reflective tools. Optimization of the electro-optic design reduces the effect of environmental disturbances and allows vibration amplitude resolution of 0.2 micrometers with flat response in the bandwidth 0.1-150 Hz. The laser beam is phase modulated by an electro-optic crystal. Modulation is required to sense the direction of target motion. The outgoing and returning light are compared in a Michelson interferometer. Author (ESA)

N81-20483# California Univ., Berkeley. Earthquake Engineering Research Center.

A RESPONSE SPECTRUM METHOD FOR RANDOM VIBRATIONS

Armen Der Kiureghian Jun. 1980 49 p refs

(Grant NSF ENG-79-05906)

(PB81-122301; UCB/EERC-80/15; NSF/RA-800201) Avail: NTIS HC A03/MF A01 CSCL 13M

A response spectrum method for stationary random vibration analysis of linear structures is developed. It can also be used as a good approximation for the response to a transient stationary Gaussian input with a duration several times longer than the fundamental period of the structure. Various response quantities, including the mean squares of the response and its time derivative, the response mean frequency, and the cumulative distribution and the mean and variance of the peak response are obtained in terms of the ordinates of the mean response spectrum of the input excitation and the modal properties of the structure. GRA

N81-20484# California Univ., Berkeley. Earthquake Engineering Research Center.

CYCLIC INELASTIC BUCKLING OF TUBULAR STEEL BRACES

Victor A. Zayas, Egor P. Popov, and Stephen A. Mahin Jun. 1980 204 p refs

(Grants NSF ENV-76-04263; NSF PFR-79-08984)

(PB81-124885; UCB/EERC-80/16; NSF/RA-800209) Avail: NTIS HC A10/MF A01 CSCL 13M

Six individual brace members (one-sixth scale models of braces of the type used for offshore platforms) were alternatively subjected to cycles of compressive inelastic buckling followed by tensile stretching. The effects resulting from different end ficity conditions (pinned vs. fixed), and from different diameter-to-wall thickness ratios (33 vs. 48) were examined and the behavior of heat treated braces were compared to the behavior of braces made from tubing as received from the manufacturer. The inelastic responses of the braces are presented and interpreted. Cyclic inelastic loadings cause changes in the mechanical material properties of the braces which subsequently reduces the buckling load. A method of predicting the reduction in buckling load is presented. The changes in material properties are identified for a 'critical section' within the plastic hinge of a brace and the reduced buckling loads under repeated cyclic loadings are calculated. GRA

N81-20485# California Univ., Berkeley. Earthquake Engineering Research Center.

THE 3D SOLID ELEMENT (TYPE 4 - ELASTIC OR ELASTIC-PERFECTLY-PLASTIC) FOR THE ANSR-11 PROGRAM

Digambar P. Mondkar and Graham H. Powell Jul. 1980 43 p refs

(Grant NSF ENV-76-04262)

(PB81-123242; UCB/EERC-80/22; NSF/RA-800293) Avail: NTIS HC A03/MF A01 CSCL 20K

A three dimensional nonlinear fine element is described which was developed for the ANSRI-II program that analyzes nonlinear structural response. The theoretical formulation are examined and computer program user's guide is presented. GRA

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography. For instrumentation see *35 Instrumentation and Photography*.

N81-20486* National Aeronautics and Space Administration, Washington, D. C.

EARTH RESOURCES: A CONTINUING BIBLIOGRAPHY, ISSUE 28

Jan. 1981 122 p

(NASA-SP-7041(28)) Avail: NTIS HC $10.50 CSCL 05B

This bibliography lists 436 reports, articles, and other documents introduced into the NASA scientific and technical information system between October 1, 1980 and December 31, 1980. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems instrumentation and sensors, and economic analysis. Author

N81-20487 Oregon State Univ., Corvallis.

IDENTIFICATION OF IRRIGATION PRACTICES USING PHOTOGRAPHIC AND OPTICAL-MECHANICAL SCANNING REMOTE SENSING TECHNIQUES Ph.D. Thesis

Shamim Naim 1981 280 p

Avail: Univ. Microfilms Order No. 8105186

A methodology to use remotely sensed data for irrigation method identification was developed. The main tasks were to: (1) analyze multidate images for different emulsions and scales to identify irrigation methods;(2) develop mission parameters; (3) develop an image interpretation key; and (4) investigate the feasibility of using a quantitative approach to irrigation method identification. Conclusions drawn from this study include image oriented analysis rather than quantitative analysis is best suited for irrigation method discrimination; CIR images provide better discrimination than black and white images;while irrigated and nonirrigated crops can be discriminated using multidate 1:1,000,000 images, for satisfactory discrimination of all irrigation methods, 1:30,000 or larger imagery is needed; and the best time for differentiating irrigation methods is the early growing season. Optimum mission parameters for flying photographic missions and an image interpretation key useful for irrigation methods discrimination was developed. Dissert. Abstr.

N81-20488 Pennsylvania State Univ., University Park.

THE DEVELOPMENT AND EVALUATION OF AN AUTOMATED REFLECTANCE MICROSCOPE SYSTEM FOR THE PETROGRAPHIC CHARACTERIZATION OF BITUMINOUS COALS Ph.D. Thesis

David Samuel Hoover 1980 282 p

Avail: Univ. Microfilms Order No. 8105741

An automated system was developed and evaluated for petrographic analysis. The basic design was that of a reflected-light microscope photometer with an automatic stage, interfaced with a minicomputer. The minicomputer was programmed to provide the following functions: photometer control, stage control, data acquisition, data computation and output, and data storage. The limiting factor in quantitative interpretation of rapid scan reflectograms is the resolution of reflectance populations of the individual maceral groups. Six factors which affected this resolution were delineated as follows: sample preparation, sampling technique, instrumental error, macerals, and grain size. Results generated from reflectance studies on the various coal macerals shed light on the geologic history of the test coals. Statistical testing indicated that reflectograms were highly reproducible, and a computer program, PETAN, was written to interpret the curves for reflectance parameters and petrographic composition. Dissert. Abstr.

N81-20489*# National Aeronautics and Space Administration, Washington, D. C.

DIGITAL PROCESSING OF REMOTELY SENSED IMAGES

Johannes G. Moik 1980 338 p refs Original document contains color illustrations

(NASA-SP-431; LC-79-16727) Avail: NTIS MF A01; SOD HC $6.50 CSCL 05B

The foundations of image processing were reviewed. Imaging techniques are discussed and include: image resolution, image enhancement, image registration, image overlaying and mosaicking, image analysis and classification, and image data compression. T.M.

N81-20490*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SNOW WATER EQUIVALENT DETERMINATION BY MICROWAVE RADIOMETRY

A. T. C. Chang, J. L. Foster, D. K. Hall, A. Rango, and B. K. Hartline Jan. 1981 22 p refs Submitted for publication

(NASA-TM-82074) Avail: NTIS HC A02/MF A01 CSCL 08L

One of the most important parameters for accurate snowmelt runoff prediction is snow water equivalent (SWE) which is contentionally monitored using observations made at widely scattered points in or around specific watersheds. Remote sensors which provide data with better spatial and temporal coverage can be used to improve the SWE estimates. Microwave radiation, which can penetrate through a snowpack, may be used to infer the SWE. Calculations made from a microscopic scattering model were used to simulate the effect of varying SWE on the microwave brightness temperature. Data obtained from truck mounted, airborne and spaceborne systems from various test sites were studied. The simulated SWE compares favorable with the measured SWE. In addition, whether the underlying soil is frozen or thawed can be discriminated successfully on the basis of the polarization of the microwave radiation. A.R.H.

N81-20491*# Ball Aerospace Systems Div., Boulder, Colo.

DEVELOPMENT OF THE COASTAL ZONE COLOR SCANNER FOR NIMBUS 7. VOLUME 2: TEST AND PERFORMANCE DATA, REVISION A Final Report, Jan. 1975 - 7 Oct. 1978

May 1979 99 p refs 2 Vol.

(Contract NAS5-20900)

(NASA-CR-166649; F78-11-Vol-2-Rev-A) Avail: NTIS HC A05/MF A01 CSCL 20F

The results of the Coastal Zone Color Scanner protoflight tests are examined in detail while some of the test results are evaluated with respect to expected performance. Performance characteristics examined include spectral response, signal to noise ratio as a function of radiance input, radiance response, the modulation transfer function, and the field of view and coregistration. The results of orbital sequence tests are also included. The in orbit performance or return of radiometric data in the six spectral bands is evaluated along with the data processing sequence necessary to derive the final data products. Examples of the raw data are given and the housekeeping or diagnostic data which provides information on the day to day health or status of the instrument are discussed. J.M.S.

N81-20492*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

LABORATORY TANK STUDIES OF A SINGLE SPECIES OF PHYTOPLANKTON USING A REMOTE SENSING FLUOROSENSOR

Clarence A. Brown, Jr., Olin Jarrett, Jr., and Franklin H. Farmer Apr. 1981 78 p refs

(NASA-TP-1821; L-14140) Avail: NTIS HC A05/MF A01 CSCL 06C

Phytoplankton were grown in the laboratory for the purpose of testing a remote fluorosensor. The fluorosensor uses a unique four-wavelength dye laser system to excite phytoplankton bearing chlorophyll and to measure the chlorophyll fluorescence generated by this excitation. Six different species were tested, one at a time, and each was grown two to four times. Fluorescence measured by the fluorosensor provides good quantitative measurement of chlorophyll concentrations for all species tested while the cultures were in log phase growth. Fluorescene cross section ratios obtained in the single species tank tests support the hypothesis that the shape of the fluoresecence cross section curve remains constant with the species (differences in fluorescence cross section ratios are a basis for determining composition of phytoplankton according to color group when a multiwavelength source of excitation is used. Linear relationships exist between extracted chlorophyll concentration and fluorescence measured by the remote fluorosensor during the log phase growth of phytoplankton cultures tested. S.F.

N81-20493*# National Aeronautics and Space Administration, Washington, D. C.

LAPR: AN EXPERIMENTAL AIRCRAFT PUSHBROOM SCANNER

Stephen W. Wharton, J. I. Irons, and F. Heugel Jul. 1980 31 p refs Submitted for publication

(NASA-TM-80729) Avail: NTIS HC A03/MF A01 CSCL 14B

A three band Linear Array Pushbroom Radiometer (LAPR) was built and flown on an experimental basis by NASA at the Goddard Space Flight Center. The functional characteristics of the instrument and the methods used to preprocess the data, including radiometric correction, are described. The radiometric sensitivity of the instrument was tested and compared to that of the Thematic Mapper and the Multispectral Scanner. The radiometric correction procedure was evaluated quantitatively, using laboratory testing, and qualitatively, via visual examination of the LAPR test flight imagery. Although effective radiometric correction could not yet be demonstrated via laboratory testing, radiometric distortion did not preclude the visual interpretation or parallel piped classification of the test imagery. Author

N81-20494*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ICAP: AN INTERACTIVE CLUSTER ANALYSIS PROCEDURE

FOR ANALYZING REMOTELY SENSED DATA
Stephen W. Wharton Jul. 1980 27 p refs
(NASA-TM-80732) Avail: NTIS HC A03/MF A01 CSCL 05B

An Interactive Cluster Analysis Procedure (ICAP) was developed to derive classifier training statistics from remotely sensed data. The algorithm interfaces the rapid numerical processing capacity of a computer with the human ability to integrate qualitative information. Control of the clustering process alternates between the algorithm, which creates new centroids and forms clusters and the analyst, who evaluate and elect to modify the cluster structure. Clusters can be deleted or lumped pairwise, or new centroids can be added. A summary of the cluster statistics can be requested to facilitate cluster manipulation. The ICAP was implemented in APL (A Programming Language), an interactive computer language. The flexibility of the algorithm was evaluated using data from different LANDSAT scenes to simulate two situations: one in which the analyst is assumed to have no prior knowledge about the data and wishes to have the clusters formed more or less automatically; and the other in which the analyst is assumed to have some knowledge about the data structure and wishes to use that information to closely supervise the clustering process. For comparison, an existing clustering method was also applied to the two data sets. Author

N81-20495*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CRITICAL PARAMETERS FOR COARSE COAL UNDERGROUND SLURRY HAULAGE SYSTEMS
David P. Maynard 15 Feb. 1981 53 p refs
(Contracts NAS7-100; DE-AI01-76ET-12548)
(NASA-CR-164075; JPL-Pub-81-11; DOE/ET-12548/4) Avail: NTIS HC A04/MF A01 CSCL 08I

Factors are identified which must be considered in meeting the requirements of a transportation system for conveying, in a pipeline, the coal mined by a continuous mining machine to a storage location neat the mine entrance or to a coal preparation plant located near the surface. For successful operation, the slurry haulage the system should be designed to operated in the turbulent flow regime at a flow rate at least 30% greater than the deposition velocity (slurry flow rate at which the solid particles tend to settle in the pipe). The capacity of the haulage system should be compatible with the projected coal output. Partical size, solid concentration, density, and viscosity of the suspension are if importance as well as the selection of the pumps, pipes, and valves. The parameters with the greatest effect on system performance ar flow velocity, pressure coal particle size, and solids concentration. A.R.H.

N81-20496# Centre National d'Etudes Spatiales, Toulouse (France).
SPACEBORNE CARTOGRAPHY OF THE EARTH [CARTOGRAPHIE SPATIALE DE LA TERRE]
1979 653 p refs In FRENCH Proc. of CNES/Inst. Geograph. Natl. Cours de Technol. Spatiale 1979, Toulouse, 5-19 Jun. 1979 Prepared in cooperation with Inst. Geograph. Natl., Paris
Avail: NTIS HC A99/MF A01

Several topics on the mapping of remote sensor data are discussed. The following are emphasized: cartography and geodesy; spacecraft motion and its influence on the geometric quality of imagery; and classical photogrammetry. For individual titles, see N81-20497 through N81-20523.

N81-20497# Institut Geographique National, Paris (France). Ecole Nationale des Sciences Geographiques.
THE GEOMETRY OF GEODESY [GEODESIE GEOMETRIQUE]
J. LeMenestrel *In* CNES Spaceborne Cartography of the Earth 1979 p 3-30 In FRENCH (For primary document see N81-20496 11-43)
Avail: NTIS HC A99/MF A01

The determination of a simple mathematical surface and the localization of points on the surface is treated, using a two dimensional geometric approach. Examples offered are point location on: (1) a solid, immobile sphere; (2) a rotating, fluid ellipsoid; (3) the geoid; and (4) on a geometrical polyhedron, for problems in three dimensional geodesy. Position data acquisition applications (triangulation, horizontal line of sight, and astronomic position measurement) are described. Extension of the method to spatial geodesy is discussed, including optical satellite observations. Results are further used to outline a Doppler method from satellite geodesy. Author (ESA)

N81-20498# Institut Geographique National, Paris (France). Ecole Nationale des Sciences Geographiques.
CARTOGRAPHY [CARTOGRAPHIE]
C. Vuillecot *In* CNES Spaceborne Cartography of the Earth 1979 p 31-49 In FRENCH (For primary document see N81-20496 11-43)
Avail: NTIS HC A99/MF A01

Cartography is defined as the field of studies as well as scientific, artistic, and technical operations based on results from direct observations on the exploitation of documentation, with the purpose of compiling maps, plans and other graphics, and of explaining their use. Different systems of planar projection, including remarks on map scale, are discussed. Cartographic systems for taking a cross section, for representing planimetric detail, and for representing terrain contour are described. Relief maps, legends, and techniques for drawing maps are also considered. Author (ESA)

N81-20499# Centre National d'Etudes Spatiales, Toulouse (France).
DYNAMIC SPATIAL GEODESY [GEODESIE DYNAMIQUE SPATIALE]
M. B. Lago *In its* Spaceborne Cartography of the Earth 1979 p 51-59 In FRENCH (For primary document see N81-20496 11-43)
Avail: NTIS HC A99/MF A01

Classical methods of spatial geodesy are discussed, then recent techniques in geodynamics and spatial oceanography are reviewed. The repartition of laser (or Doppler effect) ground, tracking stations is examined. Orbital parameters that must be determined as well as conditions to be fulfilled as to the orbits, arcs, and measurements are outlined. Models for the global restitution of the gravitational potential of the Earth are compared. The role of complementary gravimetric measurements is shown. Results obtained using GEOS C and Seasat measurements to determine local geoids are cited. A strong correlation between the restituted geoid and marine topography is shown.
Author (ESA)

N81-20500# Centre National d'Etudes Spatiales, Toulouse (France).
GENERAL REFLECTIONS [PRESENTATION GENERALE]
J. P. Carrou *In its* Spaceborne Cartography of the Earth 1979 p 65-80 In FRENCH (For primary document see N81-20496 11-43)
Avail: NTIS HC A99/MF A01

Problems of geometrical deformation affecting the quality analysis of remote imagery from artificial Earth satellites are presented. Different orbit and attitude perturbations are analyzed and their effects correlated with imaging techniques. Several types of orbit and stabilization control techniques are covered, emphasizing those appropriate to the SPOT satellite program. Image quality, specifically for scanning on the pushbroom principle, is discussed in terms of establishing a precise correspondence between an image element (pixel) and the source (ground). Numerical simulation for evaluating each parameter is mentioned. Author (ESA)

N81-20501# Centre National d'Etudes Spatiales, Toulouse (France).
GEOMETRICAL QUALITY OF SCANNING SENSOR IMAGERY [QUALITE GEOMETRIQUE DES IMAGES DES CAPTEURS A BALAYAGE]
R. Rosso *In its* Spaceborne Cartography of the Earth 1979 p 81-107 In FRENCH (For primary document see N81-20496 11-43)
Avail: NTIS HC A99/MF A01

An analysis of user needs is given in terms of imagery applications. A relationship between quality requirements and preprocessing complexity is shown. An analytic accounting of the different sources of geometric error is described. Results are used in a computer simulation of SPOT satellite imagery in order

to balance error tolerances over the entire sensor system. The simulation program is briefly described. Author (ESA)

N81-20502# Centre National d'Etudes Spatiales, Toulouse (France).
ON THE ORBITS USED FOR EARTH OBSERVATION MISSIONS [LES ORBITES UTILISEES POUR LES MISSIONS D'OBSERVATION DE LA TERRE]
P. Legendre *In its* Spaceborne Cartography of the Earth 1979 p 109-150 refs In FRENCH (For primary document see N81-20496 11-43)
Avail: NTIS HC A99/MF A01

General notions on the orbital motion of satellites are reviewed, including perturbation effects on the orbit. Two orbits are identified as particularly well-adapted to Earth sensing, i.e., geostationary orbits and phased heliosynchronous orbits. Geostationary satellite orbits are only briefly covered in introduction to an in depth analysis of heliosynchronous orbital characteristics is given. The importance of calculating a heliosynchronous orbit such that the solar illumination remains in phase for each sensor sweep is shown, citing the SPOT satellite orbit. The natural evolution of orbits is calculated for inclination and eccentricity, taking account of Sun-Moon gravitational attraction, solar radiation pressure, and other variables. Author (ESA)

N81-20503# Centre National d'Etudes Spatiales, Toulouse (France).
EARTH OBSERVATION SATELLITE ATTITUDE [L'ATTITUDE DES SATELLITES D'OBSERVATION DE LA TERRE]
P. Duchon and J. L. Marce *In its* Spaceborne Cartography of the Earth 1979 p 151-181 refs In FRENCH (For primary document see N81-20496 11-43)
Avail: NTIS HC A99/MF A01

Generalities on the choice of a pointing system and equipment used of orbital corrections as well as orientation of a spacecraft on station are presented. Specifically, three axis stabilization and stabilization by rotation are considered in relation to the intended mission. For low altitude orbits three axis stabilization is favored, taking account of both external and internal perturbations, different systems for attitude measure and control, and the possibility of ground-based attitude fine correction. As an example, the attitude measure and control configuration for the SPOT satellite is described. As an example of a spin stabilized geostationary satellite, the METEOSAT satellite attitude measure and control system is cited. Author (ESA)

N81-20504# Institut Geographique National, Paris (France).
PRINCIPLES OF PHOTOGRAMMETRY [PRINCIPES DE LA PHOTOGRAMMETRIE]
M. P. Denis *In* CNES Spaceborne Cartography of the Earth 1979 p 185-188 In FRENCH (For primary document see N81-20496 11-43)
Avail: NTIS HC A99/MF A01

A generalized methodology of photogrammetry is presented. The concept of view angle perspective is introduced and the case of two solid view angles intersecting is illustrated. The internal elements of a solid view angle are identified. The problem of locating a field of view relative to elements external to the view angle is considered. The problem of locating a field of view relative to elements external to the view angle is considered. Homologous rays are identified for two fields of view (stereoscopic observation). The reconstruction of photogrammetric data, e.g., coordinate determination, is recorded. Author (ESA)

N81-20505# Institut Geographique National, Paris (France).
APPARATUS FOR RECONSTRUCTION [APPAREILS DE RESTITUTION]
M. P. Denis *In* CNES Spaceborne Cartography of the Earth 1979 p 189-194 In FRENCH (For primary document see N81-20496 11-43)
Avail: NTIS HC A99/MF A01

Two reconstruction methods for the interpretation of stereoscopic imagery are described: (1) analytic reconstruction, based on measurements taken from photographic plates, thus reconstituting the corresponding field of view and orienting it in space by calculation; and (2) analog reconstruction, using an apparatus which instantaneously materializes the elements of the geometrical solution to an intersection problem. The necessary types of equipment to perform either of these functions are specified and the methodology of photogrammetric reconstruction is explained analytically. Author (ESA)

N81-20506# Institut Geographique National, Paris (France).
ORTHOPHOTOGRAPHY AND NUMERICAL TERRAIN MODELS [ORTHOPHOTOGRAPHIE-MODELES NUMERIQUES DE TERRAIN]
M. P. Denis *In* CNES Spaceborne Cartography of the Earth 1979 p 195-201 In FRENCH (For primary document see N81-20496 11-43)
Avail: NTIS HC A99/MF A01

Orthophotography in application for the differential enhancement of aerial photographs is discussed analytically. Geometrical illustrations of corrections for distortion due to terrain relief are presented. Terrain locally assimilable to an inclined plane is studied. Systematic deformations arising from the alteration of the image are derived. The correction of focusing distortion is also considered. The use of stereo orthophotography to compensate for vertical uneveness is discussed. Author (ESA)

N81-20507# Institut Geographique National, Paris (France).
PHOTOGRAPHIC CAMERAS AND RETURN BEAM VIDICONS [CAMERAS PHOTOGRAPHIQUES ET RBV]
A. Baudoin *In* CNES Spaceborne Cartography of the Earth 1979 p 203-230 refs In FRENCH (For primary document see N81-20496 11-43)
Avail: NTIS HC A99/MF A01

Purely photographic remote sensors, i.e., apparatus that necessitates the use of photographic film for the storage of data, as well as return beam vidicons (RBV) are studied. For each of these sensors, the instantaneous acquisition of images and their geometric quality are discussed. Generalized requirements for photographic systems operating in space are listed. Cameras flown during the Skylab program, onboard Soyuz 22, and the photo-optical systems to be flown with spacelab and the space shuttle (Large Format Camera) are described in detail. The RBVs operated onboard various LANDSAT satellites are illustrated. The operating principle as well as performance characteristics, such as resolution, geometric fidelity, and radiometric properties, are given. Author (ESA)

N81-20508# Centre National d'Etudes Spatiales, Toulouse (France).
SPACEBORNE SCANNERS FOR PHOTOELECTRIC DETECTION [LES INSTRUMENTS SPATIAUX A DETECTION PHOTOELECTRIQUE ET A BALAYAGE]
A. deLeffe *In its* Spaceborne Cartography of the Earth 1979 p 233-314 refs In FRENCH (For primary document see N81-20496 11-43)
Avail: NTIS HC A99/MF A01

Instruments for spaceborne observation, other than photo-optical cameras, are studied. The advantages, e.g., ease of image processing and data transmission, intrinsic to scanning multispectral radiometers over photo-optical systems are discussed. Functional elements making up a photoelectrical detector system are described. According to the type of observation to be made, three scanning modes are identified: (1) multispectral mechanical scanning; (2) pushbroom imagery; and (3) television camera imagery. Examples of instrumentation typical of each scanning mode are drawn from various space programs and illustrated in detail. Author (ESA)

N81-20509# Institut Geographique National, Paris (France).
THE GEOMETRY OF SCANNING IMAGERY [LA GEOMETRIE D'UN ENREGISTREMENT A BALAYAGE]
A. Baudoin *In* CNES Spaceborne Cartography of the Earth 1979 p 315-356 refs In FRENCH (For primary document see N81-20496 11-43)
Avail: NTIS HC A99/MF A01

The parameters on which the geometry of an image depends are identified and analyzed. These include: the nature of the object observed (shape and dimensions in trirectangular coordinates); the properties of the medium, (atmospheric refraction); the position or movement of the point of view; the orientation and the qualities of the imaging system (particularly for optics); and the operational characteristics of the detector. A generalized form of the geometry is developed, then applied to the nominal

geometry of satellite imagery from a circular orbit. The effect of observation platform motion is emphasized. The influence of terrain relief is shown, emphasizing stereoscopy applications. Results from the analysis are reduced to a mathematical model and the calculation of image distortion is outlined. Author (ESA)

N81-20510# Institut Geographique National, Paris (France).
POSITIONING SPOT IMAGES: RECONSTITUTION FROM A STEREOSCOPIC PAIR [LA MISE EN PLACE DE L'IMAGE SPOT. LA RESTITUTION D'UN COUPLE STEREOSCOPIQUE PAR]
D. Kirsner *In* CNES Spaceborne Cartography of the Earth 1979 p 357-365 refs In FRENCH (For primary document see N81-20496 11-43)
Avail: NTIS HC A99/MF A01

'Modifications applied to classical photogrammetry needed ior the processing of generalized images are presented. Analytical definitions of an image, a stereoscopic pair, and of a theoretical apparatus for stereoscopic image reconstruction are given. As an example, the equation system for reconstituting SPOT satellite scanner imagery is formalized. Specifically, modeling and calculation of small random distortion is shown, emphasizing the effect on instrument calibration. A flow chart of the image processing scheme is illustrated. Author (ESA)

N81-20511# Centre National d'Etudes Spatiales, Toulouse (France).
PRINCIPLE AND PERFORMANCE OF RADAR SENSORS [PRINCIPE ET PERFORMANCES DES CAPTEURS RADAR]
M. Dorrer *In its* CNES Spaceborne Cartography of the Earth 1979 p 367-378 refs In FRENCH (For primary document see N81-20496 11-43)
Avail: NTIS HC A99/MF A01

Fundamentals of side-looking radar and of synthetic aperture radar (SAR) are described, emphasizing their geometrical characteristics and the quality of the images obtained. Resolution, deformation in distance, radiometric factors, scintillation, the effects of ground relief, and radar coverage are discussed. The possibility of radar stereography is brought up and analyzed, including a scheme for a combined radar and optical system. For an aircraft mounted SAR system, highly detailed imagery is obtainable. Impulse compression, multiview, and nonfocused antenna modes are also considered. Author (ESA)

N81-20512# Centre National d'Etudes Spatiales, Toulouse (France).
SATELLITE LIMITATIONS COMPARED TO MISSION REQUIREMENTS FOR EARTH OBSERVATION [LES CONTRAINTES DUES AUX SATELLITES COMPAREES AUX EXIGENCES DES MISSIONS D'OBSERVATION DE LA TERRE]
M. Cazenave *In its* Spaceborne Cartography of the Earth 1979 p 381-392 In FRENCH (For primary document see N81-20496 11-43)
Avail: NTIS HC A99/MF A01

The constraints inherent to a spaceborne remote sensing system are reviewed qualitatively. The choices of orbit, attitude control system, and of sensing instrumentation of satellites are covered. Criteria, such as availability of onboard power supplies as well as data processing and transmission capabilities, are considered. The impact of the quality and variety of satellite imagery on the organization of ground support systems is determined. Author (ESA)

N81-20513# Centre National d'Etudes Spatiales, Toulouse (France).
RADIOMETRIC DEGRADATION OF IMAGES AND GROUND PREPROCESSING [DEGRADATIONS RADIOMETRIQUES DES IMAGES ET PRE-TRAITEMENT SOL]
G. Begni *In its* Spaceborne Cartography of the Earth 1979 p 395-436 refs In FRENCH (For primary document see N81-20496 11-43)
Avail: NTIS HC A99/MF A01

Different types of degradation which can affect a signal between its emission at the surface and its transmission to a ground station are studied. Degradation sources identified are: atmospheric effects; transfer functions and spatial discretization (effects induced by the geometry); effects related to detector gain; and instrument noise along with quantification. Two methods for the partial compensation for these effects are given. The methods involve calibration procedures as well as deconvolution and interpolation analysis as a first step in image processing. Author (ESA)

N81-20514# Institut Geographique National, Paris (France).
THE LOCALIZATION OF REFERENCE POINTS [LA LOCALISATION DES POINTS D'APPUI]
A. Baudoin *In* CNES Spaceborne Cartography of the Earth 1979 p 437-456 refs In FRENCH (For primary document see N81-20496 11-43)
Avail: NTIS HC A99/MF A01

The relationship between image coordinates (X, Y) and terrain coordinates (X, Y, Z) is defined as collinear. Specifically, reference points on an image are identified and used to determine the parameters of a geometrical model of the image. The application of digital techniques for the precise measurement of image coordinates is discussed. An interactive CRT display system is described and the constitution of a numerical file of reference points is formulated. Stereoscopic automatic correlation of points on two images is also discussed. The identification of pseudoreference points and reference lines is also considered. Author (ESA)

N81-20515# Institut Geographique National, Paris (France).
MODELS OF DEFORMATION [MODELES DE DEFORMATION]
B. Cabrieres *In* CNES Spaceborne Cartography of the Earth 1979 p 451-471 refs In FRENCH (For primary document see N81-20496 11-43)
Avail: NTIS HC A99/MF A01

Analytical models which account for image distortion due to variations in the physical parameters of a remote sensor system are derived. The vector geometry of idealized imagery is established. A direct model is constructed taking account of: satellite position given precise ephemerides; satellite attitude given pitch angle, roll, and yaw relative to the local orbit (from sensors and gyroscopes); internal structure of the imaging apparatus; the precise instant of recording each observed point; and the surface geometry under observation. Determination of the inverse model, either by interpolation or by iteration, is also illustrated. The models are evaluated using reference points and a polynomial interpolation method. The modeling of unknown parameters is also described. The SPOT satellite imagery is analyzed with respect to and deformation lattices are obtained. Author (ESA)

N81-20516# Institut Geographique National, Paris (France).
ANALOG RECTIFICATION [LA RECTIFICATION ANALOGIQUE]
Bernard Cabrieres *In* CNES Spaceborne Cartography of the Earth 1979 p 473-487 refs In FRENCH (For primary document see N81-20496 11-43)
Avail: NTIS HC A99/MF A01

Techniques and associated apparatus for rendering an aerial photograph usable in relief map applications are reviewed. General functional principles of orthoprojectors are outlined. Three types of apparatus are described: (1) a device for manual profiling and optical transfer of an image by horizontal linear elements; (2) an automatic correlator with image transfer by CRT; and (3) an image converter with optical transfer of linear elements and correction for slope. Possible application of the orthoprojector with slope correction to SPOT satellite imagery is demonstrated. Both a vertical and oblique line of sight are studied using simulated SPOT imagery. Application of analog rectification to LANDSAT imagery is also discussed. Author (ESA)

N81-20517# Centre National d'Etudes Spatiales, Toulouse (France).
GEOMETRICAL CORRECTION OF IMAGES: METHODS AND PERFORMANCE [CORRECTIONS GEOMETRIQUES D'IMAGES: METHODS ET PERFORMANCE]
B. Fleutiaux *In its* Spaceborne Cartography of the Earth 1979 p 489-515 In FRENCH (For primary document see N81-20496 11-43)
Avail: NTIS HC A99/MF A01

Diverse techniques developed for the rectification of geometric distortion in radiometric images are presented. The principle of geometric correction is explained and the nature and origin

of geometric deformations are described. The architectures of different numerical correction systems are also described. Methods for extracting reference points are illustrated. Hardware includes a mono/stereo comparator, a coordinatograph, and a user interactive console. Modeling of distortion is used to determine expressions for matching a point on an image with a homologous reference point. A global approach, a selective approach, and a hybrid approach to this problem are outlined. Rectification by interpolation, by planimetry, and by segmentation is also demonstrated. Various geometrical processing schemes are also outlined and obtainable precision is discussed. Author (ESA)

N81-20518# Centre National d'Etudes Spatiales, Toulouse (France).

PROCESSING RADIOMETRIC DATA FOR CARTOGRAPHY [TRAITEMENTS RADIOMETRIQUES POUR LA CARTOGRAPHIE]

G. Saint *In its* Spaceborne Cartography of the Earth 1979 p 519-531 In FRENCH (For primary document see N81-20496 11-43)

Avail: NTIS HC A99/MF A01

The thematic extraction of radiometric data by teledetection and the subsequent classification, either quantitative or qualitative, of the data along with determining data quality are summarized. The importance of establishing user requirements in formulating an extraction and classification scheme is emphasized. As an example, image contrast adaptation of LANDSAT imagery is considered. Other processing techniques considered are: analysis of principal and derived components; enhancement of particular features; and special filtering. The relevance of interpretive processing to numeric thematic cartography is discussed. Author (ESA)

N81-20519# Centre National d'Etudes Spatiales, Toulouse (France).

OVERVIEW OF THE SPOT MISSION AND DESCRIPTION OF THE GROUND SEGMENT [RAPPEL DE LA MISSION SPOT ET DESCRIPTION DU SEGMENT SOL]

J. C. Cazaux *In its* Spaceborne Cartography of the Earth 1979 p 535-543 In FRENCH (For primary document see N81-20496 11-43)

Avail: NTIS HC A99/MF A01

The objectives of the first SPOT satellite mission are reviewed and the organization of its ground based systems is described. Details of the satellite orbit are given along with specifications on its high resolution scanner for the visible spectrum, its optical system, and on its telemetry instrumentation. The ground segment handles command and control of the spacecraft as well as processing of received imagery. A filing system for processed data is implemented and user relations service is available. Author (ESA)

N81-20520# Centre National d'Etudes Spatiales, Toulouse (France).

THE SPOT SATELLITE IMAGE PROCESSING FACILITY IN TOULOUSE AND ITS CAPABILITIES [LE SEGMENT SOL IMAGE SPOT DE TOULOUSE ET LES PRODUITS ASSOCIES]

J. C. Cazaux *In its* Spaceborne Cartography of the Earth 1979 p 545-562 refs In FRENCH (For primary document see N81-20496 11-43)

Avail: NTIS HC A99/MF A01

The SPOT satellite image processing center is presented, emphasizing its data handling capabilities as well as how user requirements can be met. The center is composed of a space image reception station and a facility for the rectification of space images. The image rectification facility includes the subsystems archiving, preprocessing, and data display for dissemination. The functional organization of each of these subsystems is described in detail. Author (ESA)

N81-20521# Centre National d'Etudes Spatiales, Toulouse (France).

TECHNICAL DEMONSTRATION: AN INTERACTIVE SYSTEM FOR IMAGE PROCESSING [DEMONSTRATIONS TECHNIQUES: SYSTEME INTERACTIF DE TRAITEMENT D'IMAGES]

D. Borel *In its* Spaceborne Cartography of the Earth 1979 p 565-577 In FRENCH (For primary document see N81-20496 11-43)

Avail: NTIS HC A99/MF A01

A user interactive system program for thematic conditioning of images is presented. No programming knowledge is needed to operate the system. System functions include disk storage and retrieval of images, manipulation and presentation of black and white images as well as density enhanced color or composite color images, and supervised or nonsupervised multispectral classification. The implementation of additional programs in FORTRAN is possible. The system peripherals are described and the operational functions explained in detail. Author (ESA)

N81-20522# Centre National d'Etudes Spatiales, Toulouse (France).

TECHNICAL DEMONSTRATION: A HIGH DENSITY IMAGE VISUALIZATION SYSTEM [DEMONSTRATIONS TECHNIQUES: SYSTEME DE VISUALISATION D'IMAGES A HAUTE DENSITE]

D. Borel *In its* Spaceborne Cartography of the Earth 1979 p 579-581 In FRENCH (For primary document see N81-20496 11-43)

Avail: NTIS HC A99/MF A01

The basic apparatus produces high contrast photographic prints from digital data acquired in real time or from magnetic tape storage. The photographic film is fixed on a rotating cylindrical drum. An opto-electronic system processes incoming video data such that a line is printed for each rotation of the drum. After each revolution, the optico-mechanical head undergoes a translation and the process is repeated until the end ot the image. The system is interfaced with a SEMS SOLAR 16/65 computer. The apparatus has the capability to be integrated into a data acquisition and processing system for storing remote sensor data. Author (ESA)

N81-20523# Centre National d'Etudes Spatiales, Toulouse (France).

TECHNICAL DEMONSTRATION: APPARATUS FOR LOCATING LANDMARKS [DEMONSTRATIONS TECHNIQUES: DISPOSITIF DE REPERAGE D'AMERS]

D. Borel *In its* Spaceborne Cartography of the Earth 1979 p 583-587 In FRENCH (For primary document see N81-20496 11-43)

Avail: NTIS HC A99/MF A01

A point location apparatus (or coordinatograph), used for correcting geometrical distortion observed on aerial or satellite images is described. The device aids in determining the coordinates of characteristic points, both on a reference map and on an unprocessed image, restituted on photographic film. The equipment specifications are given and the output data format is listed. Author (ESA)

N81-20524# Naval Research Lab., Washington, D. C. Applied Ocean Acoustic Branch.

A LOOK AT REMOTE SENSING OF THE OCEAN TEMPERATURE STRUCTURE Interim Report

K. D. Flowers 6 Mar. 1981 22 p refs (RR0110842)

(AD-A095644; NRL-MR-4461) Avail: NTIS HC A02/MF A01 CSCL 08/10

The problem of remotely sensing the ocean temperature structure using acoustic signalling techniques is examined. Specific attention is given to the use of geometric dispersion in determining the modal construction of the acoustic field. This analysis results in plots of modal intensity vs. time and frequency. It is shown that, except in some specific simple cases, the large number of modes present and their close spacing in these dispersion plots require a resolution which is unattainable at this time. However groups of modes of relatively high intensity form patterns in these dispersion plots and should be resolvable. A straightforward comparison of measurements and theory should provide a method of remotely sensing the ocean temperature structure. This method requires experimental verification. GRA

N81-20525# Sandia Labs., Albuquerque, N. Mex.

COMPARATIVE ASSESSMENT OF FIVE POTENTIAL SITES FOR HYDROTHERMAL-MAGMA SYSTEMS: SUMMARY

W. C. Luth and H. C. Hardee Nov. 1980 54 p

(Contract DE-AC04-76DP-00789)
(DOE/TIC-11303) Avail: NTIS HC A04/MF A01

Five potential hydrothermal/magma sites were assessed: the Geysers-Clear Lake, Ca.; Long Valley, Ca.; Rio Grande Rift, NM; Roosevelt Hot Springs, Ut.; and Salton Trough, Ca. Background information (geology, geochemistry, geophysics, and energy transport) was gathered on the five sites as a preliminary stage to site selection. Criteria for site selection are that potential sites have identifiable, or likely, hydrothermal systems and associated magma sources, and the important scientific questions can be identified and answered by deep scientific holes. Recommendations were made. DOE

N81-20526# Lille Univ. (France). Lab. d'Optique Atmospherique.

CRITICAL EVALUATION OF THE RADIOMETRIC REQUIREMENTS OF SATELLITE ONBOARD EQUIPMENT FOR THE MEASUREMENT OF OCEAN COLOR [EVALUATION CRITIQUE DES EXIGENCES RADIOMETRIQUES POUR UN EQUIPEMENT MESURANT A BORD D'UN SATELLITE LA COULEUR DES OCEANS]

P. Y. Deschamps, D. Tanre, and M. Viollier Paris ESA Jul. 1980 158 p refs In FRENCH
(Contract ESA-3986/79/F-CG)
(ESA-CR(P)-1390) Avail: NTIS HC A08/MF A01

The required radiometric performance of a sensor (ocean color monitor) onboard a CMOSS satellite (coastal ocean monitoring satellite system) is defined. The sensor measures ocean color in the visible spectrum and ocean temperature in the infrared. Desired accuracy is set at + or - 20% for the measurement of chlorophyll pigment concentration, and + or - 0.5 K for the determination of ocean surface temperature. Analysis shows the necessity of high reflectance sensitivity across several bonds situated between 0.4 and 0.7 microns in order to discriminate between the influence of marine turbidity and chlorophyll pigment absorption. Interference effects due to atmospheric diffusion and ocean surface reflectance are revealed large in comparison with necessary precision. Correction algorithms are proposed. For ocean surface temperature measurement, two bands between 10.5 and 12.5 microns are suggested, which make it possible to correct for the influence of water vapor absorption.
Author (ESA)

N81-20527# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.

FUNDAMENTALS OF REMOTE SENSING RELATIONS BETWEEN SPECTRAL SIGNATURES AND PHYSICAL PROPERTIES OF CROPS

N. J. J. Bunnik 20 Sep. 1979 60 p refs Presented at Joint Res. Centre of the Comm. of European Communities, Ispra, Italy, 15-19 Oct. 1979
(NLR-MP-79035-U) Avail: NTIS HC A04/MF A01

The detection of reflected radiation by a remote sensor and the influence of the atmosphere as radiative transfer medium are described. The reflectance behavior of green crops is analyzed after the introduction of the optical characteristics of plant leaves and the soil background. Two deterministic canopy reflectance models are compared. A possible approach is proposed to correlate changing plant canopy parameters with changing reflectance values in only three spectral bands. Model simulations are used to demonstrate a systematic change of multispectral reflectance data during crop growth. Crop monitoring parameters, derived from three spectral bands, are defined. These parameters are sensitive to growth indicators. Ground based reflectance measurements are used to illustrate the dynamic behavior of several crop monitoring parameters, as predicted by model simulations. Author (ESA)

N81-20528# Colorado State Univ., Fort Collins. Dept. of Earth Resources.

A WATERSHED INFORMATION SYSTEM

Anton G. Thomsen and William D. Striffler Sep. 1980 117 p refs
(Contract DI-14-34-0001-7145)
(PB81-127433; COMPLETION-100; W81-00506; OWRT-B-160-COLO(8)) Avail: NTIS HC A06/MF A01 CSCL 08H

An information system for the analysis and simulation of mountain watersheds is described. Watershed information on topography, vegetation and soils in digital terrain models (overlays) serve as the data base for watershed analysis. Classification of snow in LANDSAT imagery and automatic generation of parameter decks for operating distributed simulation models of snowcover dynamics and streamflow generation is considered. The computer programs that generate the parameter decks have built-in calibration options for all major processes, that permit fast model calibration from an interactive computer terminal, on watersheds with varying characteristics. Options are available for simulating the effects of forest management alternatives (thinning, clearcutting) on selected forest stands. Snow course measurements and LANDSAT imagery are used for simulation updates. GRA

N81-20529# Purdue Univ., Lafayette, Ind. Water Resources Research Center.

GREEN RIVER BASIN FLOW FORECASTING MODELS

P. G. Katz and G. H. Toebes Oct. 1980 211 p refs
(PB81-124448; W81-00329; TR-136; OWRT-B-094-IND(4)) Avail: NTIS HC A10/MF A01 CSCL 08H

River flow watershed runoff models of the Green River Basin in Kentucky are needed for the efficient operation of the basin's reservoirs. Correlative linear models that relate reach outflow to reach inflows and to precipitation over the side inflow contributing watersheds offer a relatively simple, easy to use method of satisfying the requirements. Difference models were constructed for the 9 river reaches into which the Green River System had been divided previously. Submodels and basin model made by linking the submodels together were found to perform better than the linear models constructed earlier. Premultiplication of the precipitation by the average monthly runoff coefficient prior to the model identification phase was found to improve the forecasting accuracy of the resulting difference model. GRA

N81-20530# Ohio State Univ., Columbus. Engineering Experiment Station.

APPLIED RESEARCH IN ANALYTICAL PHOTOGRAMMETRY Final Report

Dean C. Merchant May 1980 84 p refs Sponsored in part by Ohio Dept. of Transportation
(PB81-127300; FHWA/OH-80/005; EES-304) Avail: NTIS HC A05/MF A01 CSCL 08B

Research conducted in the applications of large scale analytical aerial photogrammetry to surveying for transportation systems is reported. A demonstration of the improvement in accuracies of measurement of terrain elevation after special calibration is presented. New specialized hardware interfaced with a simple micro-computer for measurement of cross-sections is discussed and its performance is presented. An improved version of a field deployable comparator is also discussed. Recommendations are made for improvement of the calibration procedure, the cross-section digitizer, the comparator and for implementation of results of this research. GRA

N81-20531# Lockheed Engineering and Management Services Co., Inc., Las Vegas, Nev. Remote Sensing Lab.

SUMMARY OF THE WESTERN ENERGY OVERHEAD MONITORING PROJECT Final Report, 1 Jul. 1975 - 31 Oct. 1979

Paul Ishikawa, Jr. Nov. 1980 38 p refs
(Contract EPA-68-03-2636)
(PB81-129009; EPA-600/4-80-051) Avail: NTIS HC A03/MF A01 CSCL 13B

The Environmental Protection Agency and the National Aeronautics and Space Administration entered into a five year overhead monitoring project in June, 1975. The purpose of the joint project was to transfer from NASA to EPA hardware and software technology for processing remotely sensed digital data and to assist EPA in developing and maintaining an operational remote sensing monitoring system. The overall objective was to define, develop, and demonstrate operational remote sensing techniques to rapidly monitor, in a cost effective manner, the access with which an energy related extraction site has been, or is being, rehabilitated. The technology transfer that took place is discussed and the remote sensing monitoring system EPA is described. GRA

N81-20532# National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
NEW OBSERVATIONS ON THE DAILY VARIATIONS OF NATURAL ICE ALBEDO
S. J. Bolsenga Jul. 1980 42 p refs
(PB81-132789; NOAA-TM-ERL-GLERL-27; GLERL-CONTRIB-222; NOAA-80110401) Avail: NTIS HC A03/MF A01 CSCL 08L

Observations on the daily variation of ice albedo indicate a significant dependence of snow ice and refrozen slush ice albedo on solar altitude under clear skies. Significant albedo variations were noted under variable cloudy conditions, but attempts to quantify these processes were hampered by a lack of detailed data. Albedo variations of melting ice can be pronounced and after substantial decay the resultant albedo is a combination of ice and water reflectivity. Some measurements of near infrared ice albedo indicate that diurnal variations are even more subtle in this spectral range than for the total solar spectrum and that many additional measurements are required to obtain even preliminary conclusions. GRA

N81-20533# North Carolina Water Resources Research Inst., Raleigh.
WATER RESOURCES IN NORTH CAROLINA Annual Report
1980 72 p
(PB81-127318; UNC-WRRI-80-00; W81-00325; OWRT-A-000-NC(53)) Avail: NTIS HC A04/MF A01 CSCL 08H

The Water Resources Institute supported 35 research projects during the year covering topics such as algal blooms on the Chowan River, the effects of large scale agricultural development, the quality of the planned B. Everett Jordan Reservoir, water conservation, and wetlands protection. The nuisance blooms on the Chowan River are one of the State's most serious and baffling environmental problems. New projects recently begun include: the hydrologic impacts of peat mining, treatment of pulp mill waste water, hydrologic and water quality models for in stream flow needs, and paper mill discharge effects on the Neuse River. GRA

N81-20534# Nevada Univ. System, Reno. Water Resources Center.
BASIN DEVELOPMENT AND WATER ALLOCATION
J. W. Fordham Mar. 1980 60 p refs
(Contracts DI-14-31-0001-3104; DI-14-31-0001-3612)
(PB81-127276; PUB-41065; W81-00514; OWRT-B-038-NEV(4); OWRT-B-050-NEV(2)) Avail: NTIS HC A04/MF A01 CSCL 08H

Simulation techniques are described which would aid in the allocation of ground and surface water in semi-arid basins. The study area was Hualapai Valley in the northwestern Great Basin about 115 miles north of Reno, Nevada. The study was undertaken to simulate the combined surface and subsurface hydrology of a desert basin underground development and to determine the effects of the application of water right law on the hydrologic system. GRA

N81-20535# Minnesota Univ., Minneapolis. Limnological Research Center.
A TROPHIC CLASSIFICATION OF MINNESOTA LAKES BASED ON LAKE SEDIMENTS
H. E. Wright, Jr. Jul. 1980 23 p refs
(Contract DI-14-34-0001-7164)
(PB81-124141; W81-00322; OWRT-B-128-MINN(1)) Avail: NTIS HC A02/MF A01 CSCL 08H

The lakes sampled were selected to be representative of the wide variety of Minnesota lake types. Sediments were sampled in each of 105 lakes in the deepest water. The surface sediment samples were analyzed for diatoms, and water samples from the same lakes were chemically analyzed. Correlation between the two series by cluster analysis provided the ecological basis for the use of diatom assemblages to classify lakes. Diatom analysis of lake sediment cores were then used to reconstruct past lake conditions, and evaluate the changes in a lakes trophic status. GRA

N81-20973*# National Aeronautics and Space Administration, Washington, D. C.
DEEPENING PERSPECTIVE: A NEW LOOK AT THE OLD WORLD
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 172-200 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 08F

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N81-20536 Michigan State Univ., East Lansing.
CONSIDERATIONS IN THE DESIGN OF SOLAR ENGINES Ph.D. Thesis
L. D. Ryan 1980 215 p
Avail: Univ. Microfilms Order No. 8106436

The basic problem is to develop simple engines to convert solar radiation into useful work. Chapters are included on solar insolation and solar collectors, both flat plate and concentrators. The initial research centered on the Stirling engine. It became obvious that the displacement piston was an expensive means to add the reject heat. The displacement piston was eliminated by rotating the entire engine through the heat source for 180 degrees of rotation and cooling over the remaining 180 degrees. This modification resulted in the development of a new engine. Limited studies were conducted on the gas inside the heat ring. Pressure versus time was measured for air and Freon 12 when subjected to radiation. Freon 12 responded significantly better. Since friction is a deterrent to solar engine development, methods to minimize friction are discussed.
Dissert. Abstr.

N81-20537*# Rockwell International Corp., Downey, Calif. Space Operations and Satellite Systems Div.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY (EXHIBIT D). VOLUME 6, PART 1: COST AND PROGRAMMATICS Final Report
G. M. Hanley Washington NASA Mar. 1981 84 p refs
(Contract NAS8-32475)
(NASA-CR-3397; SSD-80-0108-6-1) Avail: NTIS HC A05/MF A01 CSCL 10A

A summary of the cost data reviewed as well as conclusions and recommendations are presented. Cost and programmatic aspects of Rockwell's SPS CR-2 reference configuration were based on the results of several contracts with NASA and independent company-sponsored activities by the Space Operations and Satellite Systems Division of Rockwell International.
T.M.

N81-20538*# General Electric Co., St. Petersburg, Fla. Corporate Research and Development.
MONITORING AND CONTROL REQUIREMENT DEFINITION STUDY FOR DISPERSED STORAGE AND GENERATION (DSG), VOLUME 1 Final Report
Oct. 1980 330 p refs Sponsored by NASA and New York State Energy Research and Development Authority Prepared for JPL 5 Vol.
(Contract JPL-955456)
(NASA-CR-164051; SRD-80-042-I-Vol-1; DOE/JPL-955456-1; JPL-9950-419) Avail: NTIS HC A15/MF A01 CSCL 10A

Twenty-four functional requirements were prepared under six categories and serve to indicate how to integrate dispersed storage generation (DSG) systems with the distribution and other portions of the electric utility system. Results indicate that there are no fundamental technical obstacles to prevent the connection of dispersed storage and generation to the distribution system.

However, a communication system of some sophistication is required to integrate the distribution system and the dispersed generation sources for effective control. The large-size span of generators from 10 KW to 30 MW means that a variety of remote monitoring and control may be required. Increased effort is required to develop demonstration equipment to perform the DSG monitoring and control functions and to acquire experience with this equipment in the utility distribution environment.A.R.H.

N81-20539*# General Electric Co., St. Petersburg, Fla. Corporate Research and Development.

MONITORING AND CONTROL REQUIREMENT DEFINITION STUDY FOR DISPERSED STORAGE AND GENERATION (DSG). VOLUME 2, APPENDIX A: SELECTED DSG TECHNOLOGIES AND THEIR GENERAL CONTROL REQUIREMENTS Final Report

Oct. 1980 168 p refs Sponsored by NASA and New York State Energy Research and Development Authority Prepared for JPL 5 Vol.

(Contract JPL-955456)

(NASA-CR-164052; SRD-80-042-II-Vol-2; DOE/JPL-955456-1; JPL-9950-419) Avail: NTIS HC A08/MF A01 CSCL 10A

A consistent approach was sought for both hardware and software which will handle the monitoring and control necessary to integrate a number of different DSG technologies into a common distribution dispatch network. It appears that the control of each of the DSG technologies is compatible with a supervisory control method of operation that lends itself to remote control from a distribution dispatch center. T.M.

N81-20540*# General Electric Co., St. Petersburg, Fla. Corporate Research and Development.

MONITORING AND CONTROL REQUIREMENT DEFINITION STUDY FOR DISPERSED STORAGE AND GENERATION (DSG). VOLUME 3, APPENDIX B: STATE OF THE ART, TRENDS, AND POTENTIAL GROWTH OF SELECTED DSG TECHNOLOGIES Final Report

Oct. 1980 46 p refs Sponsored by NASA and New York State Energy Research and Development Authority Prepared for JPL 5 Vol.

(Contract JPL-955456)

(NASA-CR-164054; SRD-80-042-III-Vol-3; DOE/JPL-955456-1; JPL-9950-419) Avail: NTIS HC A03/MF A01 CSCL 10A

Present and future relatively small (<30 MW) energy systems, such as solar thermal electric, photovoltaic, wind, fuel cell, storage battery, hydro, and cogeneration can help achieve national energy goals and can be dispersed throughout the distribution portion of an electric utility system. Based on current projections, it appears that dispersed storage and generation (DSG) electrical energy will comprise only a small portion, from 4 to 10 percent, of the national total by the end of this century. In general, the growth potential for DSG seems favorable in the long term because of finite fossil energy resources and increasing fuel prices. Recent trends, especially in the institutional and regulatory fields, favor greater use of the DSGs for the future. A.R.H.

N81-20541*# General Electric Co., St. Petersburg, Fla. Corporate Research and Development.

MONITORING AND CONTROL REQUIREMENT DEFINITION STUDY FOR DISPERSED STORAGE AND GENERATION (DSG). VOLUME 4, APPENDIX C: IDENTIFICATION FROM UTILITY VISITS OF PRESENT AND FUTURE APPROACHES TO INTEGRATION OF DSG INTO DISTRIBUTION NETWORKS Final Report

Oct. 1980 77 p Sponsored by NASA and New York State Energy Research and Development Authority Prepared for JPL 5 Vol.

(Contract JPL-955456)

(NASA-CR-164055; SRD-80-042-IV-Vol-4; DOE/JPL-955456-1; JPL-9950-419) Avail: NTIS HC A05/MF A01 CSCL 10A

Visits to four utilities concerned with the use of DSG power sources on their distribution networks yielded useful impressions of present and future approaches to the integration of DSGs into electrical distribution network. Different approaches to future utility systems with DSG are beginning to take shape. The new DSG sources will be in decentralized locations with some measure of centralized control. The utilities have yet to establish firmly the communication and control means or their organization. For the present, the means for integrating the DSGs and their associated monitoring and control equipment into a unified system have not been decided. A.R.H.

N81-20542*# General Electric Co., St. Petersburg, Fla. Corporate Research and Development.

MONITORING AND CONTROL REQUIREMENT DEFINITION STUDY FOR DISPERSED STORAGE AND GENERATION (DSG). VOLUME 5, APPENDIX D: COST-BENEFIT CONSIDERATIONS FOR PROVIDING DISPERSED STORAGE AND GENERATION FOR ELECTRIC UTILITIES Final Report

Oct. 1980 42 p Sponsored by NASA and New York State Energy Research and Development Authority Prepared for JPL 5 Vol.

(Contract JPL-955456)

(NASA-CR-164053; DOE/JPL-955456-1; JPL-9950-419; SRD-80-042-V-Vol-5) Avail: NTIS HC A03/MF A01 CSCL 10A

Cost benefit considerations are extremely important in obtaining the acceptance of dispersed storage and generation (DSG) by the electric utilities. These considerations involved somewhat different economic analyses depending on whether the generation is utility, customer, or combined ownership. It is necessary to get acceptance of more easily understood methods for evaluating the economics of DSG because much of the benefits of DSG may accrue in the generation and transmission portions of the utility system while the costs tend to be centered in the distribution portion of that system. The influence of factors, such as reliability, capital costs, and other economic measures were also investigated. T.M.

N81-20543*# National Aeronautics and Space Administration, Washington, D. C.

LARGE WIND ENERGY CONVERTER: GROWIAN 3 MW Final Report

J. E. Feustel, S. Helm, and F. Koerber Nov. 1980 90 p Transl. into ENGLISH of "Grosse Windenergieanlage Growian 3 MW. Baureife Unterlagen fuer Grosse Windenergieanlage" Rept. ET 4088A Nuremberg, Nov. 1979 92 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Maschinenfabrik Augsburg-Nuernberg A.G., Nuremberg

(Contract NASw-3199)

(NASA-TM-75404) Avail: NTIS HC A05/MF A01 CSCL 10A

The final report on the projected application of larger-scale wind turbine on the northern German coast is summarized. The designs of the tower, machinery housing, rotor, and rotor blades are described accompanied various construction materials are examined. Rotor blade adjustment devices auxiliary and accessory equipment are examined. A.R.H.

N81-20544*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

LSA FIELD TEST Annual Report, Aug. 1979 - Aug. 1980

Peter Jaffe 30 Dec. 1980 44 p refs

(Contract NAS7-100; DE-AI01-76ET-20356)

(NASA-CR-164083; JPL-PUB-81-12; DOE/JPL-1012-52) Avail: NTIS HC A03/MF A01 CSCL 10A

After almost four years of endurance testing of photovoltaic modules, no fundamental life-limiting mechanisms were identified that could prevent the twenty-year life goal from being met. The endure data show a continual decline in the failure rate with each new large-scale procurement. Cracked cells and broken interconnects continue to be the principal causes of failure. Although the modules are more adversely affected physically by hot, humid environments than by cool or dry environments there are insufficient data to correlate failure with environment. There is little connection between the outward physical condition of a module and changes in its electrical performance. T.M.

N81-20545*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

PROCEEDINGS OF THE 18TH PROJECT INTEGRATION MEETING Progress Report, Apr. - Sep. 1980

R. R. McDonald Sep. 1980 492 p refs
(Contract NAS7-100; DE-AI01-76ET-20356)
(NASA-CR-164073; JPL-Pub-80-100; DOE/JPL-1012-51; PR-16) Avail: NTIS HC A21/MF A01 CSCL 10A

The principal achievement of the Low Cost Solar Array Project in 1980 was the attainment of $2.80/Wp Technical Readiness, and that processes and equipment now commercially available can make possible a deliverable product in 1982. A prototype array for intermediate load applications was demonstrated using frameless modules. It was proof tested to 40 lb/sq ft loading, and priced at $24/sq m, including array fabrication, module installation, shipping to the site and site installation for quantities of 20 MW. L.F.M.

N81-20546*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE CORRECTION FOR SPECTRAL MISMATCH EFFECTS ON THE CALIBRATION OF A SOLAR CELL WHEN USING A SOLAR SIMULATOR
Clay H. Seaman 15 Jan. 1981 10 p refs
(Contracts NAS7-100; DE-AI01-76ET-20356)
(NASA-CR-164074; JPL-Pub-81-1; DOE/JPL-1012-50) Avail: NTIS HC A02/MF A01 CSCL 10A

A general expression was derived to enable calculation of the calibration error. The information required includes the relative spectral response of the reference cell, the relative spectral response of the cell under test, and the relative spectral irradiance of the simulator (over the spectral range defined by cell response). The spectral irradiance of the solar AMX is assumed to be known. T.M.

N81-20547*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
COST/PERFORMANCE OF SOLAR REFLECTIVE SURFACES FOR PARABOLIC DISH CONCENTRATORS
F. Bouquet 15 Jul. 1980 57 p refs Sponsored in part by DOE
(Contract NAS7-100)
(NASA-CR-164088; JPL-Pub-81-2; DOE/JPL-1060-40) Avail: NTIS HC A04/MF A01 CSCL 10A

Materials for highly reflective surfaces for use in parabolic dish solar concentrators are discussed. Some important factors concerning performance of the mirrors are summarized, and typical costs are treated briefly. Capital investment cost/performance ratios for various materials are computed specifically for the double curvature parabolic concentrators using a mathematical model. The results are given in terms of initial investment cost for reflective surfaces per thermal kilowatt delivered to the receiver cavity for various operating temperatures from 400 to 1400 C. Although second surface glass mirrors are emphasized, first surface, chemically brightened and anodized aluminum surfaces as well as second surface, metallized polymeric films are treated. Conventional glass mirrors have the lowest cost/performance ratios, followed closely by aluminum reflectors. Ranges in the data due to uncertainties in cost and mirror reflectance factors are given. A.R.H.

N81-20548*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RESULTS OF THE 1980 NASA/JPL BALLOON FLIGHT SOLAR CELL CALIBRATION PROGRAM
C. H. Seaman and R. S. Weiss 15 Mar. 1981 15 p refs
(Contract NAS7-100)
(NASA-CR-164078; JPL-Pub-81-18) Avail: NTIS HC A02/MF A01 CSCL 10A

Thirty-eight modules were carried to an altitude of about 36 kilometers. In addition to the cell calibration program, an experiment to evaluate the calibration error versus altitude was performed. The calibrated cells can be used as reference standards in simulator testing of cells and arrays. T.M.

N81-20549# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
HEAT EXCHANGE AND SOLAR ENERGY, VOLUME 2
1980 337 p refs Proc. of 1980 Lecture Ser., Rhode Saint Genese, Belgium, 28 Jan. - 1 Feb. 1980 2 Vol.
(VKI-Lec-Ser-1980-2-Vol-2) Avail: NTIS HC A15/MF A01

The heat transfer problems arising in connection the collection, storage, and utilization of solar energy are examined. The treatment of solar and meteorological data, the instrumentation and measurement technique used to obtain them as well as mathematical models and operational characteristics of various solar heating systems and their individual components are covered. Special emphasis is given to the modeling of complete solar systems, including computer simulation of their transient response. Advantages and disadvantages of energy storage based on sensible heat, phase change, and chemical reaction, along with thermomechanical solar power generation and calculation of the thermal load requirement of buildings are discussed. An analysis of economic aspects and future prospects for solar energy utilization is made. For individual titles, see N81-20550 through N81-20559.

N81-20550# Mons Univ. (Belgium).
LATENT AND CHEMICAL STORAGE
Roger Jadot *In* Von Karman Inst. for Fluid Dynamics Heat Exchange and Solar Energy, Vol. 2 1980 53 p refs (For primary document see N81-20549 11-44)
Avail: NTIS HC A15/MF A01

The thermodynamics of solar heat storage through the use of hydrates and chemical reactions are discussed. The properties of salt hydrates, and the use of encapsulation to facilitate heat flow are reviewed in the context of home systems. Glauber's salt and calcium chloride hexahydrate are cited as examples. The use of organic compounds in latent heat storage is mentioned, and a list of over 200 compounds selected from the literature is given. Reactions of NH3 with inorganic salts and other reactions are mentioned for use in a chemical heat pump. Author (ESA)

N81-20551# Technische Physische Dienst TNO-TH, Delft (Netherlands).
THE BENEFITS OF ADVANCED HEAT STORAGE SYSTEMS
C. denOuden *In* Von Karman Inst. for Fluid Dynamics Heat Exchange and Solar Energy, Vol. 2 1980 11 p refs (For primary document see N81-20549 11-44)
Avail: NTIS HC A15/MF A01

A prototype installation using sodium hydrates encapsulated in a polymer matrix with a nucleating agent was constructed. Performance tests using a version of ASHREA standard 94-77 were carried out over 300 aging cycles. Results show a 10% decrease in latent heat of fusion. Rock bed heat storage and adsorbent material heat storage are also compared. For a temperature range of 20 to 80 C, Sorbead R has a seven to ten times higher stored energy density than a rock bed.
Author (ESA)

N81-20552# Technische Physische Dienst TNO-TH, Delft (Netherlands).
A METHOD TO TUNE THE VARIOUS COMPONENTS OF A SOLAR HEATING SYSTEM
C. denOuden *In* Von Karman Inst. for Fluid Dynamics Heat Exchange and Solar Energy, Vol. 2 1980 20 p (For primary document see N81-20549 11-44)
Avail: NTIS HC A15/MF A01

The cost effectiveness of solar space and hot water heating was modeled using as a reference system an instrumented solar house. The reference system has 35 sq m of collectors and a two cu m heat storage tank. The mean annual energy yield was calculated for the climate of the Netherlands. For given component and installation costs, optimal collector area and storage tank volumes are computed. Author (ESA)

N81-20553# Katholieke Universiteit te Leuven (Belgium). Lab. voor Warmteoverdracht en Reaktorkunde.
PERFORMANCE OF AIR COLLECTOR HOUSE HEATING SYSTEMS WITH ROCK BED STORAGE
W. L. Dutre *In* Von Karman Inst. for Fluid Dynamics Heat Exchange and Solar Energy Vol. 2 1980 31 p Sponsored by Belgium Govt. (For primary document see N81-20549 11-44)
Avail: NTIS HC A15/MF A01

A solar air heating system and its control system are described and a computer model describing the dynamic behavior of the system is presented. The model is validated against short term measurements on an experimental facility. An acceptable agreement was shown between the model and the measured

temperature of the storage system. The system differential equations are solved with a half-hour time step, using half-hourly averaged meteorological data. Model runs indicate that the system performance can be improved mainly by additional storage insulation, improved heat transfer in the air collectors, and through the use of highly selective absorbers. The combination with a heat pump eliminates the need for a thermal auxiliary heating system only in the case of large storage capacities, or permits the same system efficiency with a considerably smaller storage as in the case without a heat pump. Author (ESA)

N81-20554# Mons Univ. (Belgium).
WATER SYSTEMS MODELING
J. Lagneau and C. Boussemaere *In* Von Karman Inst. for Fluid Dynamics Heat Exchange and Solar Energy, Vol. 2 1980 30 p Sponsored by Natl. Belgium Program of Energy (For primary document see N81-20549 11-44)
Avail: NTIS HC A15/MF A01

Mathematical models of two simple solar collectors and three complete solar heating systems are described and compared. Flat plate, double cover, liquid medium collectors were simulated. Hourly values of ambient temperature and global insolation on the collectors are used in the simulations of the behavior of heating systems. A finite difference scheme is used in one model and the modified Euler's method in another. Results from the former compare favorably with those from the Los Alamos Study Center model. A simplified program is described which calculates for each day the storage tank temperature resulting from the heating load, heat loss, and energy output of the collector. Author (ESA)

N81-20555# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
SYSTEM MODELING USING TRNSYS COMPUTER SIMULATION
N. Connor *In its* Heat Exchange and Solar Energy, Vol. 2 1980 23 p refs (For primary document see N81-20549 11-44)
Avail: NTIS HC A15/MF A01

Use of the program TRNSYS for design and system optimization is illustrated by transient simulation of a water heating system comparing two different types of collector, and for a swimming pool heating system. The data required for the simulations, the program modules used, and the information flow through the program are shown. Curves are presented for one year of operation, showing energy requirements, optimum collector area, and minimum annual cost all for various collector options. Performance curves are given for the pool heater. Author (ESA)

N81-20556# Joint Research Centre of the European Communities, Ispra (Italy).
THERMOMECHANICAL SOLAR POWER/ELECTRICITY GENERATION. TECHNICO-ECONOMIC PROBLEMS AND PROSPECTIVES OF DEVELOPMENT AND APPLICATION
Joachim Gretz *In* Von Karman Inst. for Fluid Dynamics Heat Exchange and Solar Energy, Vol. 2 1980 38 p refs (For primary document see N81-20549 11-44)
Avail: NTIS HC A15/MF A01

The thermodynamics of high temperature solar energy conversion are presented and the one MW Helioelectric Power Plant EURELIOS of the European Communities is described. Some particularities of hydrogen, its production with solar energy and transportation of solar energy by means of hydrogen and/or hydrogenated fuels are discussed. The solar power plant represents 80% of the overall costs and is the most cost-intensive component in the system. Solar energy conversion into mechanical power, electrolysis, and transportation of chemicals over long distances (several 1000 km) over land and sea to the user's site are surveyed. Liquid and gaseous hydrogen, methanol, and ammonia are considered. Industrial solar hydrogen production is discussed, emphasizing electrolysis. Some qualitative considerations on the influence of large scale solar energy conversion on climate indicate that there should be atmospheric heating above a plant and only a slight cooling of the ground underneath the mirrors. Author (ESA)

N81-20557# Liege Univ. (Belgium). Lab. de Physique du Batiment.
BUILDING THERMAL LOADS CALCULATIONS
Jean Lebrun *In* Von Karman Inst. for Fluid Dynamics Heat Exchange and Solar Energy, Vol. 2 1980 35 p refs (For primary document see N81-20549 11-44)
Avail: NTIS HC A15/MF A01

Thermal load calculation methods are introduced for peak, normal, and floating (summer non-heating modes) loads. Calculations needed during the preliminary design phase up through analyses of completed structures are included. Steady state and transient approaches are presented, extended from simple components (walls) through entire multiroom buildings. Electric circuit analogies are used to model heat transfer. Matrix equations are used to extend calculations to entire buildings. Transient conditions are often periodic and finite difference and convolution methods are outlined for their solution.Author (ESA)

N81-20558# Michigan Univ., Ann Arbor. Heat Transfer Lab.
THE A PRIORI DECISION IN SOLAR ENERGY AND CONSERVATION ECONOMICS
John A. Clark *In* Von Karman Inst. for Fluid Dynamics Heat Exchange and Solar Energy, Vol. 2 1980 57 p refs Repr. from Solar Energy and Conservation Systems, 1980 (For primary document see N81-20549 11-44)
Avail: NTIS HC A15/MF A01

The initial decision concerning the economic viability of a solar energy heating system or an energy conservation system is shown to involve technical, physical, meteorological, geographic, design and cost factors as well as the source of funding and type of arrangements made to finance the system. Four basic economic/technical models, which include the influence of increasing fuel costs, are presented and compared with other possible kinds of investments to determine the economic viability of the system. It is found that different economic conclusions are both possible and justifiable for investment situations having different constraints. Author (ESA)

N81-20559# Michigan Univ., Ann Arbor.
A LIFE-CYCLE MODEL FOR SOLAR HEATING SYSTEM DESIGN AND ECONOMIC EVALUATION MICHIGAN ECONOMIC MODEL FOR SOLAR HEATING (MESH)
John A. Clark *In* Von Karman Inst. for Fluid Dynamics Heat Exchange and Solar Energy, Vol. 2 1980 37 p refs Presented at Solar Energy and Conservation Symp. Miami, 11-13 Dec. 1978 (For primary document see N81-20549 11-44)
Avail: NTIS HC A15/MF A01

A model is presented which allows for both design selection and economic optimization of a solar heating system within the U.S. This model relates the life-cycle total cost of a solar heating system to the escalating cost of fuel, installed system costs per unit area of collector, the cost of capital (capital recovery factor under a mortgage contract), taxes, collector type, building load factor, degree-day heating factor, conversion efficiency of the back-up system, solar load fraction, and solar input-collector performance factors derived from the Los Alamos solar heating model. The influence of cost escalation in fuel is included by an inflation function determined by the analysis. The circumstances corresponding to an arbitrary and/or optimum (minimum total life-cycle cost) design condition are identified and explicitly determined. The influence of the principal governing parameters on solar heating design and economics in the U.S. is shown in a simple but complete form. Author (ESA)

N81-20560# Encoth Corp., Princeton, N.J.
ADVANCED THEORETICAL METHODS FOR IMPROVING THE PERFORMANCE OF THERMIONIC CONVERTERS Final Report, 13 Feb. 1979 - 12 Aug. 1980
1980 500 p
(Contract DE-AC02-79ET-15422)
(DOE/ET-15422/5) Avail: NTIS HC A21/MF A01

Seventeen papers present various aspects of an effort to quantitatively describe thermionic converter characteristics such as power efficiency and current voltage factors. Topics covered include: electron temperature profiles; electron mobility; collisional energy transfer between two species; collision matrix evaluation and convergence; solutions to the steady state Boltzmann equation using numerical relaxation and time evolution techniques; computer codes to generate collision matrices; collision integral (scattering kernel) evaluation; boundary conditions in Boltzmann and transport equations; problem formulation in a parameter

study of the thermionic converter; and a computer code for matrix convergence testing. Individual abstracts are included for each paper. A.R.H.

N81-20561# Department of Energy, Washington, D. C.
THE 1980 FLYWHEEL TECHNOLOGY SYMPOSIUM
1980 470 p refs Symp. held at Scottsdale, Ariz., Oct. 1980 Sponsored in part by ASME
(Contract W-7405-eng-48)
(CONF-801022) Avail: NTIS HC A20/MF A01

Forty-eight papers were presented at the meeting and are included in the proceedings. A separate abstract was prepared for each of 45 papers. Three papers were previously processed for EDB. DOE

N81-20562# New Zealand Energy Research and Development Committee, Auckland.
ENGINEERING STUDY OF PELLETING WASTE PAPER FOR ENERGY RECOVERY Final Report
1980 11 p refs
(NZERDC-53; ISSN-0110-1692) Avail: NTIS HC A02/MF A01

Scientific work completed by the Environmental Ethics Trust is reported. As the production of pellets, the source of raw material, and the burning characteristics were already established by the Trust, the report concentrates on the economics of production as being one of the two critical factors not yet established. These costs are given for various throughputs to determine the most economic production rate and to establish likely production costs with a given source of raw material. The other critical factor discussed is the possible market for the pellets, for without a market, the economics of the process are meaningless. DOE

N81-20563# Acres Shawinigan Ltd., Toronto (Ontario).
STUDY OF THE POTENTIAL FOR COGENERATION IN CANADA: INDUSTRIAL STEAM TURBINES. VOLUME 1: MAIN REPORT
Dec. 1979 176 p refs
(NP-25187-Vol-1) Avail: NTIS (US Sales Only) HC A09/MF A01; DOE Depository Libraries

Results of a study to determine the potential for cogeneration in Canada are presented. National, provincial, and industrial potentials for cogeneration based on responses to a questionnaire from 211 plants operating boiler plants are developed. Each of the 211 plants were subjected to a common analysis procedure to determine cogeneration capability and cost. The study defined cogeneration, and addressed the technical potential for cogeneration, the economic implications of cogeneration, and the institutional barriers which have to be overcome before cogeneration is fully accepted as an energy supply option in Canada. DOE

N81-20564# Acres Shawinigan Ltd., Toronto (Ontario).
STUDY OF THE POTENTIAL FOR COGENERATION IN CANADA: INDUSTRIAL STEAM TURBINES. VOLUME 2: ECONOMIC POTENTIAL
Dec. 1979 254 p
(NP-25187-Vol-2) Avail: NTIS (US Sales Only) HC A12/MF A01; DOE Depository Libraries

The economic potential, with the identification of the technical possibilities that could prove to be economically viable, for industrial cogeneration is discussed. Emphasis is placed on the point of view of society as a whole and as well as on what may be thought of as the direct production costs of electric power generation. These are the elements of cost that would fall within the purview of an accountant and it omits the opportunity costs of non-market elements. Calculation methods and results of the social savings and price scenarios are presented. Specifically, information on the economic potential of cogeneration in Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia is detailed. DOE

N81-20565# VIAK A.B., Vaellingby (Sweden).
ENERGY OUT OF GROUNDWATER
Torgny Agerstrand and Lars O. Eriksson Mar. 1980 42 p refs In SWEDISH
(NE/HETV-80/9) Avail: NTIS HC A03/MF A01

The purpose of this inventory is to estimate those energy resources of the built-up area which are stored in aquifers with good tapping facilities. It is presumed that the energy is extracted by conventional heat pump technique in a relatively big scale. The following conditions have to be met: (1) adequate access to ground water having ample and stable temperature, (2) facilities to exploit the ground water at a lower temperature, (3) a well built-up residential area, and (4) access to reasonably priced momentum power for the heat pump. The total power requirement per tenement will be 5. kW. Thus 295,000 tenements in build-up areas can be supplied with heat to 90 percent of their yearly requirement by means of energy from ground water and the heat pump. Conflict of interests reduce the coverage to 184,000 tenements. DOE

N81-20566# Johnson (Jay M.), Excelsior, Minn.
SUNSPACE MINNESOTA: PASSIVE SOLAR DESIGN FOR WINTER RESORTS Progress Report, Aug. 1979 - Oct. 1980
Jay M. Johnson 1980 50 p refs
(Contract DE-FG02-79R5-10130)
(DOE/R5-10130/2) Avail: NTIS HC A03/MF A01

Minnesota winter resorts are discussed as to type, size, and use. Energy needs and conservation techniques are described by cabin type and problem areas. Existing cabins are analyzed for conservation opportunities and solar retrofit potential. Cabin designs and concepts are presented including Earth sheltered buildings. DOE

N81-20567# Technical Planning, Inc., Beltsville, Md.
COORDINATION AND MANAGEMENT TASKS FOR THE IEA SOLAR HEATING AND COOLING PROGRAM AND CCMS SOLAR ENERGY PILOT STUDY Final Report
Sheila B. Blum and William J. Kennish Oct. 1980 35 p refs
(Contract DE-AC02-79CS-30108)
(DOE/CS-30108/T3; TPI/IEA/F-7) Avail: NTIS HC A03/MF A01

Both the management assistance and technical involvement are discussed for a solar system performance validation effort. An overview of the program accomplishments is presented as well as conclusions for future work. R.C.T.

N81-20568# American Heliothermal Corp., Denver, Colo.
EVALUATION OF SOLAR COLLECTORS FOR HEAT PUMP APPLICATIONS Final Report
Gary Skartvedt, Donald Pedreyra, Robert McMordie, James Kidd, Jerome Anderson, and Richard Jones Aug. 1980 154 p refs
(Contracts DE-AC04-78CS-35351; EM-78-C-04-5351)
(DOE/CS-35351/T1) Avail: NTIS HC A08/MF A01

The potential utility of very low cost (possibly unglazed and uninsulated) solar collectors to serve as both heat collection and rejection devices for a liquid source heat pump was evaluated. The approach consisted of exercising a detailed analytical simulation of the complete heat pump/solar collector/storage system against heating and cooling loads derived for typical single family residences in eight US cities. The performance of each system was measured against that of a conventional air to air heat pump operating against the same loads. In addition to evaluation of solar collector options, water tanks and buried pipe grids to provide thermal storage was considered. A determination of night sky temperature and convective heat transfer coefficients for surfaces with dimensions typical of solar collectors was included. The experiments were conducted in situ by placing the test apparatus on the roofs of houses in the Denver, Colorado, area. DOE

N81-20569# Statens Rad foer Byggnadsforskning, Stockholm (Sweden).
ENERGY CONSERVATION IN HOUSES BUILT FROM 1960
A. C. Anderson and Hakan Fjallstroem 1980 156 p refs In SWEDISH; ENGLISH summary
(SIB-R-4-1980) Avail: NTIS (US Sales Only) HC A08/MF A01; DOE Depository Libraries

An economic evaluation is present for different procedures for energy conservation in one family houses built from 1965 to 1975 in Sweden. The energy consumption was studied through measurement of heat consumption and through calculations of

heat balances. Draught preventers for the windows and different procedures lowering the in-door temperature were the most efficient measures. Insulation of different parts of the buildings are discussed technically.. DOE

N81-20570# Midwest Research Inst., Golden, Colo. Information Outreach and Dissemination Branch,
PHOTOVOLTAICS INFORMATION USER STUDY
W. W. Below, B. L. Wood, T. L. Marie, and C. L. Reinhardt Oct. 1980 220 p refs
(Contracts DE-AC02-77CH-00178; EG-77-C-01-0442)
(SERI/TR-751-652) Avail: NTIS HC A10/MF A01

The results of a series of telephone interviews with groups of users of information on photovoltaics are described. These results, part of a larger study on many different solar technologies, identify types of information each group needed and the best ways to get information to each group. Baseline data about information needs in the solar community is given. The following technological areas are emphasized: photovoltaics; passive solar heating and cooling; active solar heating and cooling; biomass energy solar thermal electric power; solar industrial and agricultural process heat; wind energy; ocean energy and advanced energy storage. DOE

N81-20571# Toledo Metropolitan Area Council of Governments, Ohio.
GROUNDWATER AS AN ALTERNATIVE ENERGY SOURCE FOR SPACE HEATING AND COOLING, GEOTHERMAL HEAT EXTRACTION
Jul. 1980 37 p refs
(Contract W-31-109-eng-38)
(DOE/TIC-11357; INFORMATION-5) Avail: NTIS HC A03/MF A01

The technology of the groundwater heat pump (GWHP), its applicability to the Toledo metropolitan area council of governments region, and relative economics of its use are addressed. The operation of the GWHP in both the heating and cooling modes is discussed as well as its advantages and disadvantages. A comparison is made between GWHP and other heating and cooling systems both in operation and cost. A detailed analysis is given to the legal implications of direct groundwater use and its related impacts. R.C.T.

N81-20572# Varian Associates, Palo Alto, Calif.
FURTHER DEVELOPMENT OF A NOVEL SOLAR CELL CONCENTRATOR PHOTOVOLTAIC CONVERTER SYSTEM Final Report
H. A. VanderPlas and P. E. Gregory Oct. 1980 45 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-7072) Avail: NTIS HC A03/MF A01

A photovoltaic converter using an optical filter to split the solar spectrum and focus the light onto two cells was built and tested. Conversion efficiencies for the test module ranged from 27.0 percent at 113 suns to 26.0 percent at 489 suns. The construction of this module was guided by a theoretical analysis of the efficiencies to be expected from a variety of bandgap combinations. Elements of the splitting approach were investigated with emphasis on the extension of the spectral splitting principle to a three gap converter. This includes the extension of the theoretical analysis to include the properties of the optical filter. The theoretical analysis is given, and the feedback provided by this analysis to the rest of the program is emphasized. Research on germanium, silicon, and AlGaAs/Al(sub x/)Ga(sub I-x/)As solar cells is described. DOE

N81-20573# Volvo Flygmotor A.B., Trollhaettan (Sweden).
DEVELOPMENT OF METHOD AND EQUIPMENT FOR ENERGY RECOVERY FROM THE EXHAUST GASES OF THE OIL-FUELED SMELTING AND HOLDING FURNACES
Ake Holm Mar. 1980 14 p In SWEDISH
(STU-78-6895) Avail: NTIS (US Sales Only) HC A02/MF A01

A heat recovery system was tested. The system consists of a flat ceramic heat exchanger and a high temperature burner for preheated combustion air. The fuel saving tests were made with a smelting furnace for aluminum. The furnace can be used as a holding furnace and for a combination of smelting and holding. When the modified furnace is used for holding only, there is 50 percent reduction of fuel consumption. Combined use renders 30 to 35 percent saving of fuel. The yearly savings are about 75,000 Skr in this case. Long time tests (about 5000 h) show no change. The equipment can be adapted to various types of oil fueled furnaces for smelting, forging, and in the glass industry. DOE

N81-20574# New Mexico Univ., Albuquerque. Bureau of Engineering Research.
OPTIMIZATION OF STORAGE IN PASSIVE SOLAR HEATING SYSTEMS Final Report
Raymond J. Bahm May 1980 228 p refs
(Contract DE-AS04-78CS-35405; EM-78-S-04-5405)
(DOE/CS-35405/T1; TR-BER-4(80)DOE-720-1) Avail: NTIS HC A11/MF A01

The search for a simple method of estimating the optimum amount of storage for passive solar space heating system designs and the results of that search are described. The project goals, and why the project is important are described. The major project results are presented in the order of their importance with respect to meeting the project goal. A narrative description of the project is given. The various approaches attempted are described, giving the reasons for failure in those areas that were not successful. Most of the data is presented in graphical form. DOE

N81-20575# United Technologies Corp., South Windsor, Conn. Power Systems Div.
EVALUATION OF BATTERY CONVERTERS BASED ON 4.8-MW FUEL CELL DEMONSTRATOR INVERTER Final Report
Oct. 1980 184 p refs
(Contract DE-AC01-76ET-26961)
(DOE/RA-26961/01) Avail: NTIS HC A09/MF A01

The use of existing self-commutated converter technology with modification for use in battery energy storage systems was evaluated. The program consists of three parts: evaluation of the cost and performance of a self-commutated converter modified to maintain production commonality between battery and fuel cell power conditioners, demonstration of the principal characteristics required for the battery application in MW-scale hardware, and investigation of the technical requirements of operation isolated from the utility system. A power-conditioning system consisting of a self-commutated converter augmented with a phase-controlled rectifier was selected and a preliminary design, prepared. A principal factor in this selection was production commonality with the fuel cell inverter system. Additional types of augmentation, and the use of a self-commutated converter system without augmentation, were also considered. A survey of advanced battery manufacturers was used to establish the dc interface characteristics. DOE

N81-20576# California Univ., Berkeley. Lawrence Berkeley Lab.
LIQUEFACTION OF BIOMASS
James T. McCartney 1980 13 p refs
(Contract W-7405-eng-48)
(LBL-PUB-350) Avail: NTIS HC A02/MF A01

The history of wood to oil conversion is presented. The conception of the liquefaction facility in Albany, Oregon and its start-up and operational difficulties are described. The chemistry of wood to oil conversion, including structural models of cellulose and lignin, is presented. DOE

N81-20577# Battelle Pacific Northwest Labs., Richland, Wash.
ADHESION AND CHEMICAL VAPOR TESTING OF SECOND SURFACE SILVER/GLASS SOLAR MIRRORS
L. S. Dake and M. A. Lind Sep. 1980 56 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3575) Avail: NTIS HC A04/MF A01

The viability of using adhesion and chemical attack as screening tests for predicting the relative long term durability of solar mirrors was assessed. Adhesion tests were performed using a commercially available thin film tensile pull tester in which a stud bonded to the film is pulled and the yield load recorded. Numerous subtleties regarding the selection of the adhesive used to bond the study and the validity of the testing procedure are discussed. Several different methods of normalizing the results were attempted in an effort to reduce the scatter in the data.

The same set of samples were exposed to salt spray, water, HCl, H_2SO_4, and HNO_3 vapors and then ranked according to their performance. Visual comparison of tested samples did not yield consistent results. Some SEM/EDX analysis was performed on these mirrors subject to accelerated degradation in order to compare them to mirrors subject to natural degradation. Insufficient data were collected to show that any of the tests performed will accurately predict the relative life expectancy of the mirrors in an outdoor environment. DOE

N81-20578# Battelle Pacific Northwest Labs., Richland, Wash.
ALTERNATE PROTECTION CONCEPTS FOR SECOND SURFACE SILVER/GLASS SOLAR MIRRORS
C. Q. Buckwalter, L. S. Dake, J. S. Hartman, and M. A. Lind Oct. 1980 21 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3629) Avail: NTIS HC A03/MF A01

Experiments were performed using Sb_2O_5-K_2O and PbO based solder glasses to edge seal a second sheet of glass over the silver mirror surface. Materials compatibility problems were encountered when using several of the commercially available PbO based solder glasses alternatives. A cursory evaluation of liquid SiO_2 and TiO_2 coatings was also undertaken. The films were applied as direct overcoats on both silver only and silver/copper mirror substrates. Although the process appeared to yield visually acceptable coatings, under microscopic examination the films were found to be porous and pinhole riddled after the final curing step. Consequently, they did not stand up well to salt spray and HCl vapor tests. Overcoating the silver or silver/copper mirrors with an electroless deposited nickel film was investigated. Two formulations, one a basic solution, the other a commercial acidic solution, were attempted. Film integrity problems were encountered for fairly thick films in the feasibility experiments attempted. DOE

N81-20579# Boeing Engineering and Construction, Seattle, Wash.
PLASTIC FILM PERFORMANCE IMPROVEMENT FOR HELIOSTATS Final Report
Jul. 1980 41 p
(Contract DE-AC04-76DP-00789)
(SAND-79-8185) Avail: NTIS HC A03/MF A01

A plastic film improvement program was initiated to improve the enclosed heliostat design. An industrial survey was initiated. Suppliers were urged to participate by providing samples of materials they felt had potential. The preliminary candidate materials were screen tested. The materials showing promise were sent to Phoenix for desert exposure testing. After 3 months of accelerated exposure, coupons were withdrawn and tested for degradation. The data were used to eliminate candidates of obvious poor weatherability, and assist the supplier in making modifications for possible second iteration materials. DOE

N81-20580# Los Alamos Scientific Lab., N. Mex.
BASIC RESEARCH NEEDED FOR THE DEVELOPMENT OF GEOTHERMAL ENERGY
R. L. Aamodt and R. E. Riecker Oct. 1980 22 p refs
(Contract W-7405-eng-36)
(LA-8562-MS) Avail: NTIS HC A02/MF A01

Basic research needed to facilitate development of geothermal energy is identified. The present state of knowledge of geothermal energy is presented and specific recommendations for further research, with status and priorities are listed. Discussion is limited to a small number of applicable concepts, namely: origin of geothermal flux; transport of geothermal energy; geothermal reservoirs; rock water interactions, and geophysical and geochemical exploration. DOE

N81-20581# Lund Univ. (Sweden).
MARINE BIOMASS: ALGAE AS SOURCE OF ENERGY
Lars Edler, Torgny vonWachenfeldt, and Lars Emmelin Apr. 1980 115 p refs In SWEDISH
(NE/BIO-80/12) Avail: NTIS (US Sales only) HC A06/MF A01

Calculations based on data from laboratory and field measurements indicate that a production of as much as 115 tons of algae (dry matter) per hectare and year could be achieved. Culture of marine algae along the Swedish coast would probably take place in shallow, sheltered waters. Using a succession of naturally occuring species a growing season of 240 days could be achieved. With a production of 115 tons dm.ha/1 year/1 an output of approximately 110 MWhT.ha/1 year/1 of methane gas would be feasible using anaerobic fermentation. The area of the Baltic inside the 5 m depth curve is 19,000 sq km. If 10% of this area were available, a production of around 20 TWhT of gas annually would be the maximum potential of the system. A system is described for growing algae in the shallow marine environment. Energy analysis of the system indicates that approximately 5% of the energy output from an algae based methane plant would be required for growth, harvesting and conversion to methane. DOE

N81-20582# Higgins, Auld and Associates, Albuquerque, N. Mex.
SOLAR COLLECTOR FOUNDATION DESIGNS
Harry E. Auld and Jeffrey B. West Sep. 1980 35 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-7070) Avail: NTIS HC A03/MF A01

Foundation designs for a solar collector facility proposed for construction at Sandia Laboratories are presented. A suggested method for placement and construction is included. A cost estimate is provided in Appendix A and the complete design calculations are presented in Appendix B. DOE

N81-20583# Sandia Labs., Albuquerque, N. Mex. Component and Subsystem Development Div.
HANDBOOK FOR CALCULATING SOLAR-INFLUENCED BUILDING HEAT LOSSES
Raymond W. Harrigan, Herbert E. Anderson, and Irving J. Hall Oct. 1980 180 p refs
(Contract DE-AC04-76DP-00789)
(SAND-79-2173) Avail: NTIS HC A09/MF A01

Monthly heat losses and gains are presented for single-pane windows having different orientations. In addition, computational techniques in both analytical and graphical form are presented to extend this information to the computation of heat losses and gains from other building elements and the evaluation of wind speed on building heat loss. Heat loss data is presented for 26 SOLMET sites. An example problem illustrates the computations involved. DOE

N81-20584# Sandia Labs., Albuquerque, N. Mex. Data Systems Development Div.
MOBILE DIGITAL DATA ACQUISITION AND RECORDING SYSTEM FOR GEOENERGY PROCESS MONITORING AND CONTROL
Kenneth B. Kimball and Harvey C. Ogden Dec. 1980 16 p
(Contract DE-AC04-76DP-00789)
(SAND-80-2123) Avail: NTIS HC A02/MF A01

Three mobile, general purpose data acquisition and recording systems were built to support geoenergy field experiments. These systems were designed to record and display information from large assortments of sensors used to monitor in situ combustion recovery or similar experiments. They provide experiments and operations personnel with easy access to current and past data for evaluation and control of the process, and provide permanent recordings for subsequent detailed analysis. The configurations of these systems and their current capabilities are briefly described. DOE

N81-20585# Radiation Monitoring Devices, Inc., Watertown, Mass.
LOW COST, SPRAYED CdTe SOLAR CELL RESEARCH Annual Progress Report, 15 Aug. 1979 - 14 Aug. 1980
H. B. Serreze, M. Squillante, S. Lis, R. Turcotte, M. Talbot, and G. Entine Sep. 1980 35 p refs
(Contract DE-AC02-77CH-00178)
(SERI/PR-8104-3-T2; AR-1) Avail: NTIS HC A03/MF A01

Techniques to produce sprayed CdTe solar cells by utilizing experimental methods similar to those previously developed to produce device quality CdS and CdSe thin films were examined. The existing technology is extended by making use of inorganic tellurium salts and by appropriately modifying the process parameters. Using this approach films of CdTe were spray deposited. Furthermore, the spray solution is very stable and the process is reproducible. Preliminary Schottky barrier solar

cell devices showed very encouraging AM1 photovoltaic behavior. DOE

N81-20586# Los Alamos Scientific Lab., N. Mex.
PERFORMANCE EVALUATION OF THE BALCOMB SOLAR HOUSE
J. Douglas Balcomb, J. C. Hedstrom, and J. E. Perry, Jr. 1980 10 p refs Presented at the Colloque Solaire Intern., Nice, 11-12 Dec. 1980
(Contract W-7405-eng-36)
(LA-UR-80-3453; CONF-801218-4) Avail: NTIS HC A02/MF A01

Additional instrumentation was added to the Balcomb solar house for a six-week period and up to 85 channels were recorded hourly. Some new findings based on an evaluation of these data are presented. The thermal comfort characteristics of four rooms are documented. Relative humidity in the living room varies from 30 to 50 percent; these data are used to infer an evaporation rate in the house of about 25 kg of water/day. The evaporation rate correlates reasonably well with greenhouse temperature. Heat storage in the greenhouse floor is estimated at about 0.30 kWh/day-m(2) based on temperatures measured at four depths. Several thermal characteristics of the rock bed are deduced. DOE

N81-20587# Los Alamos Scientific Lab., N. Mex.
SOLAR COAL GASIFICATION Quarterly Progress Report, 1 Oct. - 31 Dec. 1980
J. A. Sullivan and R. J. Jensen 1980 21 p refs
(Contract W-7405-eng-36)
(DOE/TIC-11384) Avail: NTIS HC A02/MF A01

The concept of solar coal gasification is investigated in the laboratory using the beam from a CO2 laser to simulate the radiation from a solar furnace. The parameters influencing the pyrolysis of stationary samples of Western sub-bituminous coal and the reaction of the char product with CO2 to form CO were investigated, and many of the experimental conditions required for maximizing gas yields were determined. Tests of solar coal gasification were conducted using small furnaces.DOE

N81-20588# Automation Industries, Inc., Silver Spring, Md. Vitro Labs.
OCTOBER 1980 ENVIRONMENTAL DATA FOR SITES IN THE NATIONAL SOLAR DATA NETWORK
Oct. 1980 248 p refs
(Contract DE-AC01-79CS-30027)
(SOLAR/0010-80/10) Avail: NTIS HC A11/MF A01

Tables of available meteorological data for reporting sites in the National Solar Data Network are presented for the following: insolation, temperature, wind, and humidity. A technical discussion of the instruments and measurements used to obtain these data tables is included. A map illustrating the climate zones is provided. DOE

N81-20589# Argonne Universities Association, Ill. Component Technology Div.
HEAT LOSS MODELING FOR THE ANL RESEARCH SOLAR POND
J. G. Bartzis, H. M. Domanus, and W. T. Sha May 1980 38 p refs
(Contract W-31-109-eng-38)
(ANL-CT-80-22) Avail: NTIS HC A03/MF A01

An analytical capability was developed based on using the COMMIX-SA-SP code to analyze the transient three dimensional heat losses from an arbitrary shaped solar pond. The COMMIX-SA-SP code is derived from the COMMIX-1A code. The analytical capability is demonstrated by calculating the heat losses from the ANL Research Solar Pond, which is under construction in Argonne National Laboratory. The calculations show that the two dimensional model underestimates the heat losses as compared with the three dimensional model. The yearly average heat flux approaches to within 10 percent of the steady state value after approximately 5 years of operation. Weather changes during the year create flux changes up to 4 times the average value. An insulator with thermal conductivity to thickness ratio less than 0.12 W/m/K can reduce the heat loss from a solar pond to soil by 50 percent or less. DOE

N81-20590# Fluidyne Engineering Corp., Minneapolis, Minn.
MHD AIR HEATER DEVELOPMENT TECHNOLOGY Technical Progress Report, 1 Apr. - 30 Jun. 1980
Jul. 1980 58 p refs
(Contract DE-AC01-80ET-15602)
(DOE/ET-15602/T2) Avail: NTIS HC A04/MF A01

Technology development for the directly-fired high temperature air heater (HTAH) for MHD power plants is described. Three tasks are described: (1) Materials selection, evaluation, and development: the objective of this task is to continue development of ceramic materials technology for the directly fired HTAH, including compilation of materials data, materials selection for testing and design studies, materials property determination. (2) Operability, performance, and materials testing: the objectives are to demonstrate the technical feasibility of operating a directly fired HTAH (including both the heater matrix and valves), to continue obtaining information on life and corrosion resistance of HTAH materials, and to obtain design information for full scale studies and future design work. (3) Full scale design concepts. DOE

N81-20591# Gould, Inc., Rolling Meadows, Ill.
DEVELOPMENT OF ZINC-BROMINE BATTERIES FOR UTILITY ENERGY STORAGE Annual Report, 1 Sep. 1978 - 31 Aug. 1979
Ronald A. Putt, Alan J. Attia, Po-Yen Lu, and James H. Heyland May 1980 161 p refs Sponsored in part by Electric Power Research Inst.
(Contracts DE-AC02-78ET-29345; EW-78-C-02-4984; EPRI Proj. RP635-2)
(DOE/ET-29345/21; AR-1) Avail: NTIS HC A08/MF A01

Development work on the Zn/Br battery is reported. A major improvement was the use of a bipolar cell design; this design is superior with respect to cost, performance, and simplicity. A cost and design study for an 80 kWh module resulted in a cost estimate of $54/kWh(1979$) for purchased materials and components, on the basis of 2500 MWh of annual production. A cell submodule (nominal 2 kWh) of full sized electrodes (1 sq ft) accured over 200 continuous cycles in a hands off, automatic routine with efficiencies in the range of 53 to 56 percent. Initial testing of a full sized 8 kWh submodule demonstrated energy efficiencies of 65 to 67 percent. DOE

N81-20592# GEOMET, Inc., Gaithersburg, Md.
WIND ENERGY RESOURCE ATLAS. VOLUME 4: THE NORTHEAST REGION
K. E. Pickering, J. M. Vilardo, J. T. Schakenbach, D. L. Elliott (Pacific Northwest Lab.), W. R. Barchet (Pacific Northwest Lab.), and R. L. George (Pacific Northwest Lab.) Sep. 1980 228 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3195-WERA-4) Avail: NTIS HC A11/MF A01

This atlas is composed of introductory and background information, a regional summary of the wind resource, and assessments of the wind resource in each state of the region. Background is presented on how the wind resource is assessed and on how the results of the assessment should be interpreted. A description of the wind resource on a regional scale is then given. The results of the wind energy assessments for each state are assembled in this chapter into an overview and summary of the various features of the regional wind energy resource. An introduction and outline are provided for in the descriptions of the wind resource given for each state. Assessments for individual states are presented. The state wind energy resources are described in greater detail than is the regional wind energy reyource, and features of selected stations are discussed. DOE

N81-20593# Joint Center for Graduate Study, Richland, Wash.
INVESTIGATION OF SOLAR CELLS BASED ON Cu20 Final Progress Report, 1 May 1979 - 30 Apr. 1980
Larry C. Olsen 30 Jun. 1980 67 p refs
(Contract DE-AC02-79ET-23006)
(DOE/ET-23006/4) Avail: NTIS HC A04/MF A01

Copper oxide was investigated as a possible material for low cost solar cells. Emphasis was placed on: (1) Cu20 substrate fabrication and characterization; (2) studies of Cu20 cell photocurrent; and (3) Cu20 solar cell studies. Large grain polycrystalline Cu20 substrates were fabricated by first oxidizing

copper discs at 1050 C, and then polishing both sides to obtain 20 mm thick wafers. Optical constants were measured with ellipsometry and investigations of material microstructure were conducted. Other procedures as well as significant results are reported. DOE

N81-20594# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
NONEQUILIBRIUM PHOTOCHEMICAL REACTIONS INDUCED BY LASERS Final Report
J. I. Steinfeld 7 Apr. 1980 8 p refs
(Contracts DE-AS02-76ET-33056; EY-76-S-02-2793)
(DOE/ET-33056/15) Avail: NTIS HC A02/MF A01

Two principal issues were addressed: how the multiple infrared photon excitation process is initiated in a polyatomic molecule; and how to understand the chemical processes which ensue following such excitation. The first question was addressed by the technique of diode-infrared laser-double resonance. Sulfur hexafluoride was chosen as the test molecule. Power broadening induced by the pump beam, transitions in the 2 v3 reverse arrow v3 manifold, and relaxations within the v3 vibrational level brought about by collisions between SF6 and other molecules of SF6, He, and CH3F were observed. The results indicate that rotational broadening of the excited-state absorption band envelopes may play a significant role in anharmonicity compensation, and that rotational relaxation proceeds mainly by collisions which reorient the angular momentum with respect to the internal coordinates of the SF6 molecules, but leave the total J quantum number nearly unchanged. The double resonance signals were satisfactorily interpreted in terms of standard 2- and 3- level models, with the possible exception of some collisional redistribution of intensity. DOE

N81-20595# Microwave Associates, Inc., Burlington, Mass.
HIGH CONCENTRATION SILICON PHOTOVOLTAIC CELL DEVELOPMENT Interim Report, Nov. 1978 - Feb. 1980
G. Allendorf, R. Frank, J. Goodrich, and W. Matthei Jun. 1980 113 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-7068) Avail: NTIS HC A06/MF A01

The objective of this study is to develop practical semiconductor photocells: for use in high concentration system (at least 25 suns at air mass one), having 18 percent or more efficiency, using state of the art silicon material and device technology, and amenable to low cost photovoltaic production of electrical energy from solar radiation. Work accomplished at Microwave Associates from the initiation of the contract on 27 November 1978 to 29 February 1980, is described. DOE

N81-20596# PRC Energy Analysis Co., Los Angeles, Calif.
SATELLITE POWER SYSTEM (SPS) UTILITY INTEGRATION: INSTITUTIONAL, PLANNING AND OPERATIONAL ISSUES
Meredith Crist, John Hill, Allan D. Kotin, and James A. Rabe Oct. 1980 205 p refs
(Contract DE-AC01-79ER-10041)
(EAC-R-4015) Avail: NTIS HC A10/MF A01

Management and organizational arrangements are needed to incorporate 300 GW of Satellite Power System (SPS) electrically into the US utility grid. Locating a sufficient number of suitable rectenna sites in the eastern United States to serve projected load centers on a proportional basis appears to be difficult. Transmission distances from rectennas to load centers could be a problem in the western United States. Long transmission distances are undesirable from a technical point of view but can be managed. More significant is the fact that long transmission lines associated with SPS would consistently cross state (and other regulatory) boundaries. However, siting exercises suggest that 60 rectennas could be located in eligible areas within the continental United States to serve projected load centers without violating the current state of the art of electricity transmission and load management. DOE

N81-20597# Royal Inst. of Tech., Stockholm (Sweden).
SILVER-IRON BATTERIES
O. Lindstroem Apr. 1980 52 p In SWEDISH; ENGLISH summary
(STU-78-4981) Avail: NTIS HC A04/MF A01

Production methods for iron electrodes were studied. It was found that a sintering temperature of 700 C gave the best strength and capacity. Production methods and additions for silver electrodes were also studied. The capacity of the produced iron and silver electrodes were 1100 mAh/cu cm. Different separators were investigated. Cellophane I and II from Du Pont was found to be the best. In tests open cells achieved 60 percent of the calculated capacity. In order to minimize the increase of the pressure in closed cells different additions to the electrodes were studied. DOE

N81-20598# Argonne National Lab., Ill.
ENVIRONMENTAL ASSESSMENT FOR THE SATELLITE POWER SYSTEM CONCEPT DEVELOPMENT AND EVALUATION PROGRAM. ATMOSPHERE EFFECTS
D. M. Rote, K. L. Brubacker, and J. L. Lee Nov. 1980 128 p refs
(Contract W-31-109-eng-38)
(DOE/ER-0090) Avail: NTIS HC A07/MF A01

The issues associated with SPS activities in the troposphere were examined. These include tropospheric weather modification related to rectenna operations and rocket launches, and air quality impacts related to rocket launch ground clouds. Then progressing upward through the various levels of the atmosphere, the principal middle and upper atmospheric effects associated with rocket effluents were analyzed. Finally, all of the potential SPS atmospheric effects are summarized. DOE

N81-20599# Martin Marietta Aerospace, Denver, Colo.
THE 10-KILOWATT PHOTOVOLTAIC CONCENTRATOR ARRAY FABRICATION
J. A. Sanders, R. L. Donovan, and S. Broadbent Dec. 1980 292 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-7062) Avail: NTIS HC A13/MF A01

The PCA is based on the use of an acrylic Fresnel lens to concentrate sunlight on high intensity solar cells. The array with modified heat sinks was fabricated to determine the impact on electrical performance due to lower weight heat sinks and reduced thermal dissipation surfaces. The cost optimization study identified a new lower weight heat sink design that would reduce the heat sink weight by 50% and the array cost by approximately 3.1% for a loss of only 7% in annularized electrical power generation. The production cost estimate provides an indicator that an overall 87% learning curve can be achieved and the cost of the 5000th uint could be $5.30 per watt in 1979 dollars. DOE

N81-20600# AEG-Telefunken, Wedel (West Germany). Fachbereich Neue Technologien, Raumfahrt.
EXPERIMENTAL STUDY TO DEFINE DEVELOPMENTS FOR TERRESTRIAL SOLAR CELL GENERATORS Final Report
Hans Gochermann, Willi Pschunder, and G. Wahl Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 144 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-143; ISSN-0340-7608) Avail: NTIS HC A07/MF A01

Materials, industrial processes, and design configurations were analyzed in order to define an economically attractive photovoltaic solar generator. System analyses and tests were performed, interconnection and encapsulation techniques for solar cells were developed, and a 1kW solar generator was built for performance measurements. Special solar cells were developed and fabricated, using single crystalline silicon and unconventional polycrystalline silicon. Cost reductions through the use of large area wafers and from the modification of process steps for solar cell fabrication are demonstrated. Further cost reduction are shown possible by using cheaper materials for contacts, interconnectors, encapsulation, etc. Using the fabricated prototype cells, two types of solar cell modules, i.e., glass and plastic encapsulations were developed, favoring the modular design of solar generators. Accelerated life test results for solar cell aging characteristics along with generator operational electrical data are given.
Author (ESA)

N81-20601# Konstanz Univ. (West Germany). Fakultaet fuer Physik.
MATERIALS AND METHODS FOR THE DEVELOPMENT OF

SOLAR ENERGY Final Report
Ernst Bucher Bonn Bundesministerium fuer Forschung und Technologie Aug. 1980 29 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-065; ISSN-0340-7608) Avail: NTIS HC A03/MF A01

Intermediate valency thermoelectric materials were investigated. Materials for thin film solar cells were sought. The following materials were selected for detailed studies: Zn3P2, WSe2, and InSe. They are found suitable for the production of cheap thin film solar cells. The usefulness of polycrystalline p-silso material for Cr/Cu/Cr and Y barrier systems was also investigated. Both diodes remain stable over a period of 10 months. The results indicate that with some optimization, a considerable improvement can be obtained in the performance of MOS solar cells. Author (ESA)

N81-20602# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
FABRICATION OF AMORPHOUS SILICON SOLAR CELLS, USING AN INDUSTRIAL PROCESS Final Report [REALISATION DE CELLULES SOLAIRES A BASE DE SILICIUM AMORPHE PAR UN PROCEDE INDUSTRIEL]
E. Fabre and S. Laou Aug. 1980 18 p refs In FRENCH, ENGLISH summary
(Contract DGRST-78.7.0050)
(LEP-80.638.SME-689-A) Avail: NTIS HC A02/MF A01

An industrial way of depositing amorphous silicon was investigated using a commercially available plasma reactor with a large throughput (AMP 300, APPLIED MATERIALS). A conversion efficiency of 1% was obtained for a metal insulator semiconductor structure with platinum, and a 1 cu cm area. An important field effect was observed upon the collection efficiency. The homogeneity of the layers is very good. R.C.T.

N81-20603# British Aerospace Dynamics Group, Bristol (England). Electronic and Space Systems.
STUDY OF INTERACTION BETWEEN SOLAR ARRAYS AND ATTITUDE - ORBIT CONTROL VOLUME 1: TECHNICAL REPORT Final Report
R. J. Annett Paris ESA Apr. 1980 181 p refs
(Contract ESA-3412/77)
(ESS/SS-987-Vol-1; ESA-CR(P)-1382-Vol-1) Avail: NTIS HC A09/MF A01

Interface criteria for the specification of solar arrays and attitude control systems for given mission profiles were defined for an Earth observation satellite, a high accuracy, heavy pointing platform and a heavy, geostationary, communications satellite. A double roll-out, a hybrid and an ultra-lightweight panel array were chosen with power levels varying from 1 1/4 kW to 3 kW per wing. Mathematical techniques were developed to modify the array modal data to enable the array design to be performed independently of the center body and general system parameters. The dynamic interaction between the array flexure and various controller algorithms was examined by analytical and simulation techniques and the limits of applicability of specific algorithms are defined. The impact of these modal parameter boundaries are re-evaluated in terms of allowable domains for the dominant structural parameters. Allowable array configurations are shown for given controller algorithms for specific mission senarios. Author (ESA)

N81-20604# Ford, Bacon and Davis, Inc., New York.
ENERGY EMERGENCY CONTINGENCY PLAN
Nov. 1980 179 p refs Prepared in cooperation with Tri-State Regional Planning Sponsored in part by DOT Commission, New York
(PB81-128704; UMTA-NY-09-0054-80-1) Avail: NTIS HC A09/MF A01 CSCL 08L

The feasibility of implementing certain contingency measures to relieve or eliminate capacity shortfalls on subsidized bus transportation under the auspices of the New Jersey Transit Corporation is detailed. The primary purpose is to evaluate effective short range strategies to expand existing transit services, capable of being implemented within two weeks, should a reduction of fuel supplies curtail travel by automobile. The study area is in the nine northern counties of New Jersey under Tri-State jurisdiction. GRA

N81-20605# Swedish Council for Building Research, Stockholm.
FLAT PLATE THERMAL SOLAR COLLECTORS: A PHYSICAL BACKGROUND
Per Isakson 1980 105 p refs
(PB81-135741; ISBN-91-540-3329-2; D35-1980) Avail: NTIS HC A06/MF A01 CSCL 10A

A physical background to the energy balance of flat plate solar collectors is provided. This background gives an idea of the wide range of literature available on the subject. GRA

N81-20606# National Bureau of Standards, Washington, D.C. National Engineering Lab.
RESIDENTIAL SOLAR DATA CENTER MIRADS USER'S GUIDE Final Report
Patricia M. Christopher, Michael Vogt, and Douglas Hall Oct. 1980 145 p refs Sponsored by HUD
(PB81-132268; NBSIR-80-2144) Avail: NTIS HC A07/MF A01 CSCL 10A

The Residential Solar Data Center Project staff in the Center for Building Technology, National Bureau of Standards, maintains a computerized data base containing noninstrumented residential data from the DOE/HUD Solar Heating and Cooling Demonstration Program. Data contained in the solar data base are accessible online to users of the NBS Center Computer via remote terminals with a data base retrieval software package called MIRADS (Marshall Information Retrieval And Display System). This document is a self teaching user's guide to the solar data base. It is complete with the basic MIRADS language rules, examples of use, and a step by step walk through of a typical interactive session. Appendices contain all the data element names and coded values needed to use the solar data with MIRADS, as well as many examples of actual computer sessions. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N81-20607 Iowa State Univ. of Science and Technology, Ames.
FINITE ELEMENT SIMULATIONS OF STRATIFIED FLOW OVER SIMPLE GEOMETRICAL OBSTRUCTIONS AND ARBITRARILY COMPLEX TERRAIN Ph.D. Thesis
John Michael Leone, Jr. 1980 138 p
Avail: Univ. Microfilms Order No. 8106023

The Galerkin finite element method (GFEM) was used to examine isothermal flow over a step, stratified flow over a thin vertical plate, and stratified flow across the Owens Valley. For the isothermal flow, the code solved the 2-D primitive variable, steady state, Navier-Stokes equations. The Boussinesq approximation was incorporated into the code for the stratified runs. The first problem examined was the isothermal flow over a step in a channel ($u = v = 0$ on the top boundary) for Reynolds number 200. The cause of wiggles seen in GFEM solutions of this problem are discussed along with comments on one proposed solution to the wiggles problem, upwinded finite element methods. Results are also presented for the Stokes problem, $Re = 0$, and for less restrictive top boundary conditions. The flow across the thin plate was used to gain experience with a GFEM stratified code. A discussion of boundary conditions problems caused by the nontrivial hydrostatic pressure is included. Dissert. Abstr.

N81-20608*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE 1979 SOUTHEASTERN VIRGINIA URBAN PLUME STUDY. VOLUME 2: DATA LISTINGS FOR NASA CESSNA AIRCRAFT
Gerald L. Gregory, Robert B. Lee, III, and Joe J. Mathis, Jr. Feb. 1981 200 p
(NASA-TM-81860-2) Avail: NTIS HC A09/MF A01 CSCL 13B

The data reported are these measured onboard the NASA Langley chartered Cessna aircraft. Data include ozone, nitrogen

oxides, light scattering coefficient, temperature, dewpoint, and aircraft altitude. T.M.

N81-20609*# National Aeronautics and Space Administration, Washington, D. C.
ANNOYANCE FROM LIGHT AIRCRAFT INVESTIGATION CONDUCTED AROUND FOUR AIRPORTS NEAR PARIS
Feb. 1981 64 p Transl. into ENGLISH of "Le Gene Causee par l'aviation legre-enquete effectuee autour de quatre aerodromes de la region Parisienne" (France), Feb. 1978 p 73-130 and 146-160 Translation was announced as N81-10577 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Centre d'Etudes et de Recherches Psychologiques Air (CERPAIR), Saint Cyr l'Ecole, France
(Contract NASw-3199)
(NASA-TM-76532) Avail: NTIS HC A04/MF A01 CSCL 13B

Maps of the four aerodromes and the results of polls taken in those areas are presented. The Guttman scale and the Green and Loevinger criteria were reviewed. The weighting factors and matrices of correlation are described. Extracts of the talks in one district and the questionnaire used are presented. T.M.

N81-20610# New Orleans Univ., La. Dept. of Chemistry.
A STUDY OF GAS SOLID REACTIONS AND AIR POLLUTION DETECTORS Final Report, 1 Sep. 1977 - 31 Oct. 1980
George G. Guilbault 5 Jan. 1981 9 p refs
(Grant DAAG20-77-G-0226)
(AD-A095253; ARO-15237.3-C) Avail: NTIS HC A02/MF A01 CSCL 13/2

Piezoelectric crystal detectors were developed for assay of ammonia, hydrogen chloride, hydrogen sulfide, explosives, organophosphorous compounds, toluene and carbon monoxide. Sensitivity was observed in the part-per-billion range, along with fast responses (10-15 seconds) and high selectivity. GRA

N81-20611# EnviroPlan, Inc., West Orange, N.J.
DESCRIPTION, EVALUATION, AND SENSITIVITY ANALYSES ANALYSES OF PRINCIPAL US EPA AIR QUALITY PREDICTION MODELS
A. R. Greenway, H. M. Ellis, and R. J. Deland Aug. 1980 125 p refs
(Contract W-31-109-eng-38)
(ANL/EES-TM-111) Avail: NTIS HC A06/MF A01

The scientific validity of the principal assumptions used in the US Environmental Protection Agency (EPA) air pollution prediction models was reviewed. The computational assumptions and equations used in the principal EPA models were reviewed, as was the recommended applicability of these models and their performance as reported in validation and comparison studies. In addition, a sensitivity analysis of model response to input parameter changes was conducted. It is concluded that the RAM (Urban) Model tends to overpredict the impact of sources with tall stacks, even in urban areas due to the treatment of unstable cases. The RAM (Urban) Model implicitly accounts for building-effect downwash through enhanced plume spreading rates. The CRSTER Model performs well when the ratio of stack height to receptor height is high, but leads to overpredictions when the ratio is low. In complex terrain cases involving moderate stack heights, the CRSTER Model tends to overpredict. A sensitivity analysis showed that the CRSTER Model is more sensitive to input parameter values than the RAM Model. DOE

N81-20612# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
GRAPHITIC CARBON IN URBAN ENVIRONMENTS AND THE ARCTIC
H. Rosen, A. D. A. Hansen, R. L. Dod, L. A. Gundel, and T. Novakov Oct. 1980 38 p refs Presented at General Motors Res. Lab. Conf., Particulate Carbon: Atmospheric Life Cycle, Warren, Mich., 12-14 Oct. 1980
(Contract W-7405-eng-48)
(LBL-11677; CONF-8010135-2) Avail: NTIS HC A03/MF A01

Recent measurements of aerosol particles indicate the presence of a large optically absorbing component which can cause visibility degradation and climatic effects. The nature of this absorbing species was investigated by a variety of modern methods of analysis, which has led to its identification on a microscopic level as graphitic (black) carbon. The use of photoacoustic and Raman spectroscopy are described and extended to the quantification of graphitic carbon and its absorption coefficient. Results from the Arctic are also presented, which show the presence of graphitic carbon concentrations comparable to those found in urban environments. DOE

N81-20613# Los Alamos Scientific Lab., N. Mex.
PHYSICAL AND CHEMICAL CHARACTERISTICS OF MT. ST. HELENS AIRBORNE DEBRIS
W. A. Sedlacek, G. H. Heiken, E. J. Mroz, E. S. Gladney, D. R. Perrin, R. Leifer (DOE, New York), I. Fisenne (DOE, New York), L. Hinchliffe (DOE, New York), and R. L. Chuan 1980 35 p refs Presented at the Symp. and Workshop on the Mount St. Helens Eruption, Washington, D.C., 18-19 Nov. 1980
(Contract W-7405-eng-36)
(LA-UR-81-110; CONF-801160-2) Avail: NTIS HC A03/MF A01

Tephra and aerosols from the May 18, 1980 eruption of Mt. St. Helens, Washington were sampled in the lower stratosphere with a WB-57F aircraft. The main body of the plume was intercepted over western Kansas on May 20, 48 hours after the eruption, at an altitude of 15.2 km. Concentrations on filter samples were 26 ng of 504/g of air and 579 ng of ash/g of air. Angular glass pyrociasts ranged in size from 0.5 to 10 (MU)m, with a mean grain size of 2 (MU)m. Samples collected at altitudes of 16.7 and 12.5 km had only traces of 504 and ash. A second flight was flown, 72 hours after the eruption, on May 21, from north Texas to central Wyoming, at an altitude of 15.2 km, < 0.5 to 38 ng of ash/g of air and 1.0 to 2.2 ng of 504/g of air were sampled. At an altitude of 18.3 km, from central Wyoming to NW New Mexico, the plume density and character were variable. Glassy pyroclasts similar to those sampled on the first flight range in size from 0.5 to 4 (MU)m dia. DOE

N81-20614# California Univ., Berkeley. Lawrence Berkeley Lab. Engineering and Technical Services Div.
AEROSOL ANALYSIS FOR THE REGIONAL AIR POLLUTION STUDY
J. M. Jaklevic, R. C. Gatti, F. S. Goulding, B. W. Loo, and A. C. Thompson May 1980 52 p refs
(Contract W-7405-eng-48)
(LBL-6497) Avail: NTIS HC A03/MF A01

The design and operation of an aerosol sampling and analysis program implemented during the 1975 to 1977 St. Louis Regional Air Pollution Study is described. A network of ten samplers were operated at selected sites in the St. Louis area and the total mass and elemental composition of the collected particulates were determined. Sampling periods of 2 to 24 hours were employed. The samplers were capable of collecting aerosol particles in two distinct size ranges corresponding to fine and coarse particles. DOE

N81-20615# California Univ., Livermore. Lawrence Livermore Lab.
ATMOSPHERIC STUDIES IN COMPLEX TERRAIN (ASCOT) INFORMATION SURVEY
Marvin H. Dickerson, ed. May 1980 254 p refs
(Contract W-7405-eng-48)
(UCID-18572; ASCOT-80-3) Avail: NTIS HC A12/MF A01

A comprehensive, though not all-inclusive, survey of atmospheric studies in complex terrain is reported. The work is divided into three major sections: 1 physical concepts: 2 modeling; and 3 measurements. Each section contains a brief review and discussion of subtopics accompanied by a number of references. Although the ASCOT program concentrated on noctural drainage wind studies during the past two years, material that spans a broader aspect of atmospheric flow in complex terrain is included. DOE

N81-20616# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
SOOT IN THE ATMOSPHERE
T. Novakov Oct. 1980 36 p refs Presented at the General Motors Res. Lab. Conf. on Particulate Carbon: Atmospheric Life Cycle, Warren, Mich., 12-14 Oct. 1980
(Contract W-7405-eng-48)

(LBL-11676; CONF-8010135-4) Avail: NTIS HC A03/MF A01

The relative amounts of primary and secondary carbonaceous material in atmospheric aerosols are assessed and differentiation made between secondary carbonaceous species produced by photochemical and nonphotochemical reactions. The approach used most extensively involves the use of an optical attenuation technique, combined with total particulate carbon determination. The black component of soot, which is an unambiguous tracer for primary emissions, is conveniently monitored because of the large and uniform optical absorptivity. The black carbon content of the particles is easily determined by an optical attenuation method. Determination of total particulate carbon mass enables the study of the relations between the black and the total carbon content. DOE

N81-20617# Zeiss (Carl), Oberkochen (West Germany).
LASER SPECTROSCOPY FOR THE ENVIRONMENT Final Report
Helmut Fischer, Manfred Kriese, Juergen Kuhl, Siegfried Neumann, Fritz Riemer, Josef Schulig, Gunther Schumann, Hans Spitschan, Heinz Sprongl, Max Straube et al Bonn Bundesministerium fuer Forschung und Technologie Jun. 1980 27 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-014; ISSN-0340-7608) Avail: NTIS HC A03/MF A01

Results from work on the suitability of dye laser spectroscopy for the spectroanalytical detection of metals are applied to the remote analysis of contaminant in the atmosphere. An electrostatic dust precipitator for sampling fine atmospheric particles was developed. Flame spectroscopy techniques were adapted to atomic absorption spectroscopic dust analysis. Instrument calibration and possible matrix effects on measurements were investigated. Variation in sensitivity is linked to variations in conditions (lines analyzed; atomization of samples) for atomic absorption spectroscopy. Author (ESA)

N81-20618# Little (Arthur D.), Inc., Cambridge, Mass.
METAL PARTICULATE EMISSIONS FROM STATIONARY SOURCES. VOLUME 2: CHARACTERIZATION OF COLLECTION FILTERS Final Report
Edward T. Peters, J. Ronald Lawter, and Arthur L. Benson Dec. 1980 58 p refs
(Contract EPA-68-02-1219)
(PB81-121154; EPA-600/2-80-203) Avail: NTIS HC A04/MF A01 CSCL 13B

A laboratory evaluation of aerosol collection efficiency and flow resistance of filters potentially useful in EPA sampling programs was designed with respect to several variables, including particle size; gas velocity; and aerosol composition and density. Filter collection efficiencies were measured for the various evaluation parameters with a DOP penetrometer or sodium flame photometer. With two exceptions, collection efficiencies of greater than 99 percent were obtained for all filters and test conditions. The exceptions, tested with 0.3 micrometers MMD Na Cl aerosol, were Millipore Mitex and Whatman 41 filters, with collection efficiencies of 75 and 50 percent, respectively. GRA

N81-20619# Kentucky Bureau of Highways, Lexington.
PROPAGATION OF TRAFFIC NOISE Final Research Report
Kenneth R. Agent and Charles V. Zegeer Mar. 1980 88 p refs
(PB81-123523; RR-540) Avail: NTIS HC A05/MF A01 CSCL 13F

The effects of various traffic, ground cover, and geometric conditions on traffic noise propagation were evaluated in this study. There were two general methods of data collection. The first method consisted of using as many as four sound level meters and graphic level recorders to take simultaneous recordings of the traffic stream; the second method involved a constant noise source using a random noise generator. GRA

N81-20620# Environmental Protection Agency, Ann Arbor, Mich. Control Technology Assessment and Characterization Branch.
COMPARISON OF GAS PHASE HYDROCARBON EMISSIONS FROM LIGHT-DUTY GASOLINE VEHICLES AND LIGHT-DUTY VEHICLES EQUIPPED WITH DIESEL ENGINES
Penny Carey and Janet Cohen Sep. 1980 31 p refs
(PB81-122996; EPA-AA-CTAB/PA-80-5) Avail: NTIS HC A03/MF A01 CSCL 13F

Existing data on gas phase hydrocarbon exhaust emissions from both gasoline vehicles and vehicles equipped with diesel engines are consolidated. Recent studies show that diesel emissions contain compounds of high molecular weight. This high molecular weight component is dominated by particle bound hydrocarbons; however, the potential health risk associated with heavy hydrocarbons merits examination of the gas phase as well. Particular emphasis is placed on the comparison of emissions and their potential carcinogenicity. Other areas discussed include evaporative hydrocarbon emissions and the effect of fuel composition on gasoline gaseous hydrocarbon emissions. GRA

N81-20621# Purdue Univ., Lafayette, Ind. Water Resources Research Center.
INDIANA FIVE-YEAR WATER RESOURCES RESEARCH AND DEVELOPMENT PLAN. FISCAL YEARS 1982 - 1986
1980 135 p refs Sponsored by Office of Water Research and Technology
(PB81-121253; W81-00279) Avail: NTIS HC A07/MF A01 CSCL 13B

The geographical location of Indiana is such that it receives an ample supply of water on an average annual basis through precipitation. However, substantial and generally unpredictable variations in the precipitation as the water supply source have direct and essentially immediate impacts whose seriousness depends on a number of factors. Indiana water resources problems are categorized into six areas: (1) hydrologic and hydraulic processes; (2) planning and institutions; (3) water quality; (4) atmospheric and precipitation processes; (5) hydrologic ecologic relationships; and (6) water supply, development and management. Research priorities were determined for these six areas are discussed. GRA

N81-20622# Illinois Univ. at Urbana-Champaign. Inst. for Environmental Studies.
MODIFIED FACTOR ANALYSIS OF SELECTED RAPS (REGIONAL AIR POLLUTION STUDY) AEROSOL DATA Final Report
Daniel J. Alpert and Philip K. Hopke Nov. 1980 85 p refs
(PB81-120784; EPA-600/2-80-195) Avail: NTIS HC A05/MF A01 CSCL 13B

Target transformation factor analysis (TTFA) was applied to an analysis of a subset of the aerosol composition data acquired during the regional air pollution study for St. Louis, Mo. The capability of TTFA to resolve sources of airborne particulate matter in a set of ambient aerosol samples was evaluated. Only the samples from July and August 1976, both fine and coarse fractions, were examined. Because of the large number of different sources in the St. Louis area, superior results were obtained from the examination of the variation in aerosol composition with time at a single location rather than the spatial variation of over multiple sites during a shorter time period. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N81-20623 Iowa State Univ. of Science and Technology, Ames.
A MODEL OF THE ANTARCTIC SINK FOR STRATOSPHERIC WATER VAPOR Ph.D. Thesis
Anne Ritger Douglass 1980 133 p
Avail: Univ. Microfilms Order No. 8106007

A model based on temperatures derived from satellite-measured radiances and temperatures measured by radiosonde, was developed to determine the maximum quantity of water vapor removed from the Antarctic stratosphere for the winter of 1973. The temperatures in the 225 - 30 mb region of the Southern Hemisphere winter stratosphere produce saturation

mixing ratios with respect to ice which are less than the mean mass mixing ratio of stratospheric water vapor, and ice particles are formed. The removal of these ice particles from the stratospheric due to gravitational setting is the sink mechanism. The magnitude of the sink depends upon the amount of water initially present, the minimum saturation mixing ratio; and the latitudinal extent of the cold temperatures. The fall times, calculated from the Stokes-Cunningham relation, are not long compared to the duration of the cold temperatures. Therefore, the sink magnitude also depends upon the wind field, in particular, the extent to which meridional motion involves air from latitudes initially outside the region of very cold temperatures.

Dissert. Abstr.

N81-20624 Michigan Univ., Ann Arbor.
A THEORETICAL AND EXPERIMENTAL STUDY ON THE ATOMIC OXYGEN CORONA IN THE EARTH'S ATMOSPHERE Ph.D. Thesis
Jeng-Hwa Yee 1980 157 p
Avail: Univ. Microfilms Order No. 8106253

The existence of an atomic oxygen corona in the Earth's atmosphere was examined theoretically and experimentally. This corona is formed in general by the nonthermal oxygen atoms produced in the ionosphere. These nonthermal atoms have long free paths in the exosphere and can ascend to higher altitudes to form the corona lying above the thermosphere. Exothermic chemical reactions are considered the major sources for these nonthermal atoms. During magnetic storms, charge exchange and momentum transfer with the precipitated energetic O+ ions produce large numbers of energetic oxygen atoms at high latitudes. A polar oxygen corona is therefore formed. The number density of the nonthermal oxygen atoms dominates over the ambient density at approximately 800 km. Increases in the 7320-30A emission which arises from the metastable transition between O+(2P) and O-(2D) states following photoionization excitation of the atomic oxygen are expected as a result of the increase in oxygen atom column density. Dissert. Abstr.

N81-20625 Georgia Inst. of Tech., Atlanta.
RESOLVING THE HEAT-FLOW ANOMALY AT THE GALAPAGOS SPREADING CENTER Ph.D. Thesis
Patricia Lynn Patterson 1980 174 p
Avail: Univ. Microfilms Order No. 8105695

Two dimensional, finite-difference, porous medium models were developed for hydrothermal circulation at the Galapagos Spreading Center. The models span the entire region of the Galapagos heat-flow anomaly and by means of an assumed heat-transfer coefficient allow for convective, as well as conductive, heat transfer from the crust to the overlying ocean. The models incorporate the theoretically predicted heat-flow distribution into their bottom and ridge-axis boundaries, and for some permeability and heat-transfer coefficient functions predict mean ocean-bottom conductive heat flows in accord with the average measured values, thus resolving the heat-flow anomaly. Dissert. Abstr.

N81-20626 California Univ., Davis.
DETERMINATION OF REGIONAL EVAPOTRANSPIRATION USING ENERGY BALANCE, PLANETARY BOUNDARY LAYER TRANSFER COEFFICIENTS AND REGULARLY RECORDED DATA Ph.D. Thesis
Salisu Abdulmumini 1980 153 p
Avail: Univ. Microfilms Order No. 8105366

An energy balance procedure for the determination of actual regional evapotranspiration using regularly recorded global solar radiation and Rawinsonde data was developed. The energy balance procedure was applied on small agricultural watersheds in southwestern Iowa and the large Black Vermillion watershed in northeastern Kansas. Energy balance methods were found to be superior to aerodynamic methods, especially on daily and 2 day basis. Radiation balance method gave better estimates of net radiation than empirical estimates from solar radiation only. Vertically averaged temperature and specific humidity were found to be better planetary boundary layer (PBL) scales for computing surface fluxes of sensible and latent heats, respectively, than observed values of the variables at the top of the planetary boundary layer. Among the aerodynamic methods, best results were obtained when the similarity function D was assumed to be a fraction of (not equal to) the similarity function C. Results at the Black Vermillion watershed were not as good as the Treynor Basin watersheds. The reduced accuracy was because the energy balance estimates were compared to less accurate water balance estimates. Dissert. Abstr.

N81-20627 Virginia Polytechnic Inst. and State Univ., Blacksburg.
THE PETROLOGY AND GEOCHEMISTRY OF THE BALTIMORE MAFIC COMPLEX, MARYLAND Ph.D. Thesis
Barry Benton Hanan 1980 247 p
Avail: Univ. Microfilms Order No. 8105332

The Baltimore Mafic Complex consists of several metaperidotite-gabbro blocks and a belt of bimodal theleiitic and calc-alkaline metavolcanic rocks, and ultramafic-mafic supracrustal deposits that were tectonically emplaced in the metasediments of the Wissahickon Formation. Petrographic and mineral chemical data indicate that the peridotite-gabbros underwent subsolidus recrystallization in the presence of fluid resulting in the addition of interstitial magnesio-hornblende and spinel to the cumulus mineral assemblage olivine + orthopyroxene + clinopyroxene + plagioclase by recrystallization. Later addition of fluid accompanied the development of microfractures and recrystallization to produce actinolite and clinozoisite. Mineral-chemical relationships of the coexisting pyroxenes and magnesio-hornblende suggest that the temperature was near 750 C and the pressure between 5 and 8.5 Kb during this event. Magnesio-hornblende chemistry suggests that the pressure was slightly higher in the Baltimore Block relative to the Susquehanna Block.

Dissert. Abstr.

N81-20628 Pennsylvania State Univ., University Park.
GEOLOGY AND GEOCHRONOLOGY OF THE HALLORAN HILLS, SOUTHEASTERN CALIFORNIA, AND IMPLICATIONS CONCERNING MESOZOIC TECTONICS OF THE SOUTHWESTERN CORDILLERA Ph.D. Thesis
Ed H. DeWitt 1980 317 p
Avail: Univ. Microfilms Order No. 8105724

Geologic mapping and isotropic mineral analyses within the Halloran Hills indicate that older Precambrian siliceous metasedimentary rocks were regionally metamorphosed to amphibolite facies and discordantly intruded by middle Proterozoic granitic to granodioritic plutons. Two members of the upper Precambrian Pahrump Group, the Crystal Spring and Kingston Peak Formations, locally overlie the Precambrian crystalline basement. Cambrian sandstone and limestone are juxtaposed against the Pahrump along the Riggs thrust fault. The relationships among Mesozoic thrust faulting, regional metamorphism, and plutonism in the southwestern Cordillera are evaluated in light of existing literature and structural and isotopic data from this study. A model involving approximately constant dip subduction of the oceanic plate, heating of a region behind or continentward of the plutonic arc and consequent formation of metamorphic terranes, and minor subduction of continental lithosphere beneath the metamorphic terrains to form the foreland fold and thrust belt is presently preferred. Dissert. Abstr.

N81-20629 Columbia Univ., New York.
REFLECTION AND TRANSMISSION OF OBLIQUELY INCIDENT RAYLEIGH WAVES AT A VERTICAL DISCONTINUITY Ph.D. Thesis
Thomas Chui-Tung Chen 1980 148 p
Avail: Univ. Microfilms Order No. 8104916

The amplitude and phase spectra of Rayleigh waves from two nearby earthquakes seaward of the Tonga trench are studied in detail to obtain their focal depths and mechanisms. The pattern of horizontal deviatoric stress inferred from the focal mechanisms is consistent with the bending of the oceanic lithosphere before subduction. An elastic plastic model which satisfies existing bathymetric and geophysical data is proposed to explain the mechanical behavior of the oceanic lithosphere. The theoretical aspects of Rayleigh wave energy partition at a vertical discontinuity between two welded quarter spaces are examined. Some concepts of the particle motion of inhomogeneous P and SV waves, which interfere constructively to form Rayleigh waves, are corrected. This method is extended to layered media, so as to study the effects of continental margins on Rayleigh wave propagation. The theoretical solutions are compared with observations from an ocean bottom seismograph and a nearby land station. Implications for geophysical measurements based

on Rayleigh wave amplitudes are commented upon.
Dissert. Abstr.

N81-20630 California Inst. of Tech., Pasadena.
EVIDENCE FOR FAULT ASPERITIES FROM SYSTEMATIC TIME-DOMAIN MODELING OF TELESEIMIC WAVEFORMS Ph.D. Thesis
John Edward Ebel 1981 149 p .
Avail: Univ. Microfilms Order No. 8105122

A detailed analysis of two foreshocks, the main shock and two aftershocks, from the August 11, 1965 New Hebrides Islands earthquake sequence is presented. A detailed source study of the short period P waves from the Borrego Mountain earthquake in Southern California is reported. The existence of asperities on the fault zones in the two source regions is inferred. In the New Hebrides three asperities are proposed, one at the northern end of the 1965 seismic zone, one between the islands of Santo and Mallikolo, and one near the southern end of the main shock fault plane. The sequence of events reflects a pattern of the loading and breaking of asperities on the fault. For the Borrego Mountain earthquake the short period sources represent the breaking of two asperities. The stress drops of the two events were several hundred bars each while the average stress drop for the entire event was about 20 bars. For both the New Hebrides events and the Borrego Mountain earthquake, the area of the asperities which ruptured during the main event was no more than 15% of the total fault area. Dissert. Abstr.

N81-20631 Wisconsin Univ. - Madison.
RADAR INVESTIGATIONS OF THE ROSS ICE SHELF Ph.D. Thesis
Kenneth Charles Jezek 1980 221 p
Avail: Univ. Microfilms Order No. 8025828

Airborne and surface radar soundings were carried out over the Ross Ice Shelf as part of the Ross Ice Geophysical and Glaciological Survey. These data were analyzed to obtain detailed maps of ice thickness, flow lines, surface and bottom crevasse fields and locally detailed studies of bottom crevasses from which inferences were made about the recent history of the ice shelf, the present mass balance of the ice shelf, and the implication for future changes in the West Antarctic Ice Sheet. Airborne radar sounding data tied to surface data, were used for broadbased analysis of the ice shelf. Ice thickness contours show the ice shelf to be a complex, dynamic system. The correlation of some of the ice thickness anomalies with ocean floor topography and bottom and surface crevasse fields suggests that the grid western Ross Ice Shelf is characterized by a number of previously unidentified ice rises-areas where the ice shelf becomes grounded on highs in the ocean floor. Dissert. Abstr.

N81-20632 Columbia Univ., New York.
GEOPHYSICAL INVESTIGATIONS OF THE SOUTHERN CONTINENTAL MARGIN OF AUSTRALIA AND THE CONJUGATE SECTOR OF EAST ANTARCTICA Ph.D. Thesis
Michael Kong 1980 344 p
Avail: Univ. Microfilms Order No. 8104943

The magnetic quiet zones on the rifted continental margins of the Southeast Indian Ocean are associated with a characteristic pattern of geophysical anomalies. Each quiet zone is bounded on its seaward side by the oldest identified marine magnetic lineation, for the most part anomaly 22. Trend and extent of anomaly 22 were used to determine a new pole of rotation, located at 1.5 degrees N. lat., 37.0 degrees E. long., for the fit of Australia against Antarctica. This reconstruction is considerably less tight than previously proposed ones, due to the inclusion of an intracratonic rift zone, and avoids any overlap of continental material; it also satisfies the existing geological constraints governing the positioning of Australia against Antarctica. The geometry of the Australian-Antarctic rift in conjuction with the evidence for a continential depositional environment of the rift-valley sedimentary sequence necessitates the existence of a structural barrier near the western extremity of the rift. Such a barrier is postulated to have extended from the Naturaliste Block of southwestern Australia to the Bruce Spur off Knox Coast, Antarctica. Dissert. Abstr.

N81-20633 Johns Hopkins Univ., Baltimore, Md.
AN ASYMPTOTIC METHOD FOR DETERMINING THE TRANSPORT OF HEAT AND MATTER BY CREEPING FLOWS WITH STRONGLY VARIABLE VISCOSITY; FLUID-DYNAMIC PROBLEMS MOTIVATED BY ISLAND ARC VOLCANISM Ph.D. Thesis
Stephen John Samuel Morris 1981 165 p
Avail: Univ. Microfilms Order No. 8106628

Two extreme types of plume are found: in the free plume, the thermal boundary layer is maintained by the entrainment wind due to the deformation layer, whereas in the bound plume it is maintained by the external isoviscous flow. The free plume is completely self determining and a modification of the asymptotic method is used to determine its motion. A scaling argument is used to determine the height at which the external circulation begins to maintain the plume. Dissert. Abstr.

N81-20634# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
AVERAGE NOCTURNAL AND SEASONAL VARIATIONS OF SODIUM NIGHTGLOW AT 23 DEG S, 46 DEG W
V. W. J. H. Kirchhoff, B. R. Clemesha, and D. M. Simonich Dec. 1980 8 p refs
(INPE-1957-RPE/271) Avail: NTIS HC A02/MF A01

The seasonal variation of the nocturnal average intensity, and the typical variation of the sodium airglow intensity during the night were deduced, using a data set that was accumulated over a period of five years. The maximum intensity, which occurs at the equinoxes, is about two to three times as large as the intensity during winter, when the intensity of the D2 line is about 30 Rayleighs. The nocturnal variation is symmetrical about midnight, where the intensity is some 30% less than just after (before) dusk (dawn) values. T.M.

N81-20635# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
LONGITUDINAL DIFFERENCES IN THE SPREAD F CHARACTERISTICS IN THE AMERICAN ZONE AND IMPLICATIONS ON THE F-REGION DYNAMO
M. A. Abdu, J. A. Bittencourt, and I. S. Batista Nov. 1980 30 p refs
(INPE-1941-RPE/260) Avail: NTIS HC A03/MF A01

A comparative study is carried out of the spread F occurrence rates at Fortaleza (4 deg S, 38 deg W) and Huancayo (12 deg S, 75 deg W), two stations located along the magnetic equator in the American zone. While there are similarities in the gross features of the range type spread F occurrences, profound differences, on a seasonal basis, are present in the case of the frequency type spread F at the two stations. Profound dissimilarities are observed in the evening enhancement in the F region vertical drift velocity (V) measured over Jicamarca (and the F region height changes observed over Huancayo), with respect to that observed over Fortaleza, in that the seasonal trends in the local times of prereversal V peak occurrences are in exactly opposite sense at the two stations. An attempt is made to interpret these results in terms of the differences in the magnetic field declinations at the two stations that cause significant differences in the conjugate E region sunset directions and, hence, in differing rates of F region polarization electric field developments at these stations. Author

N81-20636# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
BRAZILIAN MAGNETIC ANOMALY
N. B. Trivedi Oct. 1980 5 p refs Proposed for presentation at Intercienc.
(INPE-1935-RPE/258) Avail: NTIS HC A02/MF A01

A brief description of Brazilian Magnetic Anomaly is presented. How charged particles precipitate and produce bremsstrahlung X-rays in the atmosphere of the magnetic anomaly region is explained. Details of the balloon experiment to measure bremsstrahlung X-rays in the atmosphere are given. Author

N81-20637*# Dartmouth Coll., Hanover, N.H.
EVIDENCE FOR MAGNETIC FIELD RECONNECTION AT THE EARTH'S MAGNETOPAUSE
B. U. O. Sonnerup, G. Paschmann (Max-Planck Inst. fuer Physik und Astrophysik, Garching, West Germany), I. Papamastorakis

(Max-Planck Inst. fuer Physik und Astrophysik, Garching, West Germany), N. Sckopke (Max-Planck Inst. fuer Physik und Astrophysik, Garching, West Germany), G. Haerendel (Max-Planck Inst. fuer Physik und Astrophysik, Garching, West Germany), S. J. Bame (LASL), J. R. Asbridge (LASL), J. T. Gosling (LASL), and C. T. Russell (California Univ., Los Angeles) 20 Jan. 1981 78 p refs
(Grant NsG-5348)
(NASA-CR-164066) Avail: NTIS HC A05/MF A01 CSCL 04A

Eleven passes of the ISEE satellites through the frontside terrestrial magnetopause were identified, where the plasma velocity in the magnetopause and boundary layer was substantially larger than in the magnetosheath. The nature of the plasma flow, magnetic field, and energetic particle fluxes in these regions were examined, with a view to determining whether the velocity enhancements can be explained by magnetic field reconnection. T.M.

N81-20638*# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
STRUCTURE OF THE LOW LATITUDE BOUNDARY LAYER
N. Sckopke (Max-Planck Inst. fuer Physik und Astrophysik, Garching, West Germany), G. Paschmann (Max-Planck Inst. fuer Physik und Astrophysik, Garching, West Germany), G. Haerendel (Max-Planck Inst. fuer Physik und Astrophysik, Garching, West Germany), B. U. Oe. Sonnerup (Dartmouth College), S. J. Bame, T. G. Forbes, E. W. Hones, Jr., and C. T. Russell 1 Sep. 1980 60 p refs Revised
(Contract NAS5-25772; Grants NsG-5348; NSF ATM-79-20277; NASA Order S-50864A)
(NASA-CR-164056) Avail: NTIS HC A04/MF A01 CSCL 04A

Observations at high temporal resolution of the frontside magnetopause and plasma boundary layer, made with the LASL/MPE fast plasma analyzer onboard the ISEE 1 and 2 spacecraft, revealed a complex quasiperiodic structure of some of the observed boundary layers. A cool tailward streaming boundary layer plasma was seen intermittently, with intervening periods of hot tenuous plasma which has properties similar to the magnetospheric population. While individual encounters with the boundary layer plasma last only a few minutes, the total observation time may extend over one hour or more. T.M.

N81-20639*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
RESEARCH OF THE STATE OF CONVECTION IN THE EARTH'S MANTLE Final Report, 1 May 1979 - 28 Feb. 1981
Micheline C. Roufosse Mar. 1981 27 p refs
(Grant NCC5-10)
(NASA-CR-163989) Avail: NTIS HC A03/MF A01 CSCL 08G

The behavior and mechanical properties of the lithosphere are studied. Geoid heights derived from the GEOS 3 and SEASAT radar altimeters were used. The following predictive capabilities are discussed: location of unknown seamounts from the knowledge of the geoid heights; prediction of gravity field from the knowledge of the topography and past history of the relief; or insight into the history of a region from the knowledge of both topography and geoid heights. Several geographical areas were studied, including the Walvis Ridge and Rio Grande Rise in the Southern Atlantic Ocean and several seamount chains in the Central Pacific Ocean. Two main factors influence geoid height: conditions of creation and age of the lithosphere at the time of loading. S.F.

N81-20640*# Smithsonian Institution, Washington, D. C. National Air and Space Museum.
ANALOGS OF MARTIAN EOLIAN FEATURES IN SOUTHWESTERN EGYPT Final Technical Report
Farouk El-Baz Apr. 1981 7 p refs
(Contract NsG-7486)
Avail: NTIS HC A02/MF A01 CSCL 08G

Emphasis was placed on the morphology and patterns of streaks in the Uweinat region, the relationship of topography to streak patterns, and correlation of field and laboratory studies of the desert surface sediments with color and tonal variations seen from orbit. The research objectives were to provide the necessary groundtruth information on terrestrial eolian features in order to properly interpret the orbital data and to use the interpretations as a basis for investigation of Martian eolian features. T.M.

N81-20641*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
DENSITY MEASUREMENT IN AIR WITH A SATURABLE ABSORBING SEED GAS Semiannual Progress Report, 1 Jul. - 31 Dec. 1980
Donald Baganoff Mar. 1981 44 p refs
(Grant NAG2-36)
(NASA-CR-164063) Avail: NTIS HC A03/MF A01 CSCL 04A

Resonantly enhanced scattering from the iodine molecule is studied experimentally for the purpose of developing a scheme for the measurement of density in a gas dynamic flow. A study of the spectrum of iodine, the collection of saturation data in iodine, and the development of a mathematical model for correlating saturation effects were pursued for a mixture of 0.3 torr iodine in nitrogen and for mixture pressures up to one atmosphere. For the desired pressure range, saturation effects in iodine were found to be too small to be useful in allowing density measurements to be made. The effects of quenching can be reduced by detuning the exciting laser wavelength from the absorption line center of the iodine line used (resonant Raman scattering). The signal was found to be nearly independent of pressure, for pressures up to one atmosphere, when the excitation beam was detuned 6 GHz from line center for an isolated line in iodine. The signal amplitude was found to be nearly equal to the amplitude for fluorescence at atmospheric pressure, which indicates a density measurement scheme is possible. M.G.

N81-20642# Visidyne, Inc., Burlington, Mass.
BALLOONBORNE LIDAR EXPERIMENT Final Report, 9 Jun. - 9 Dec. 1980
O. Shepherd, G. Aurilio, R. D. Bucknam, R. W. Brooke, and A. G. Hurd Hanscom AFB, Mass. AFGL 24 Dec. 1980 130 p refs
(Contract F19628-80-C-0094; AF Proj. 6690)
(AD-A095366; VI-577; AFGL-TR-80-0373) Avail: NTIS HC A07/MF A01 CSCL 04/1

The object of this contract was to design a balloonborne lidar experiment capable of performing nightime atmospheric density measurements in the 10 to 40 km altitude domain with a resolution of 100 meters. The payload includes a frequency-tripled Nd:YAG laser with outputs at 353 and 1064 nm, a telescoped receiver with PMT detectors, a command-controlled optical pointing system, and support systems, including thermal control, telemetry, command, and power. Density measurements would be made using the back-scattered 353 nm radiation data with aerosol corrections obtained from 1064 nm radiation scatterings. GRA

N81-20643# Naval Ocean Systems Center, San Diego, Calif.
TROPOSPHERIC REFRACTIVITY PROFILES INFERRED FROM RF MEASUREMENTS PASSIVE REFRACTIVE INDEX BY SATELLITE MONITORING (PRISM) Final Report, Oct. 1977 - Sep. 1980
K. D. Anderson 24 Oct. 1980 101 p refs
(SF12141491)
(AD-A095498; NOSC/TR-629) Avail: NTIS HC A06/MF A01 CSCL 04/1

The objective of this work was to develop and validate a technique for passively inferring the tropospheric refractivity structure from observations of low-angle, satellite-to-ground RF transmissions. Eleven measurements of dual-frequency radio transmissions were made. The ducting structure was correctly inferred in seven of the lower frequency and five of the high-frequency observations. The inferred profile structure can differ significantly from the observed refractive structure. The major limitation to the applicability of this technique is an uncorrectable rms range error of about 4 km. These errors are caused by small-scale refractivity fluctuations in the atmosphere. Although moderate success was achieved in inferring the refractive structure from RF measurements, it is recommended that this project be terminated, since operationally significant data cannot be extracted reliably. GRA

N81-20644# New Mexico State Univ., Las Cruces. Physical Science Lab.

D-REGION ELECTRON DENSITY MEASUREMENTS OBTAINED BY PARTIAL REFLECTION TECHNIQUES Final Report

D. Mott, W. Gammill, and R. Valdez Nov. 1980 126 p refs (Contract DAAD07-79-C-0008)

(AD-A095566; ERADCOM/ASL-CR-80-0008-4) Avail: NTIS HC A07/MF A01 CSCL 04/1

D-region electron densities are derived utilizing a ground based partial reflection sounder. The sounder frequency is approximately 2 MHz, with right hand and left hand polarized pulses transmitted vertically. This report describes the sounder system hardware and the necessary software to derive electron densities from the returned vertical pulses. A complete set of schematics of the electronics, antenna array and operational are included. A total of 604 electron density profiles have been reduced with the sounder located at White Sands Missile Range (WSMR) and at Red Lake, Canada, as part of the 1979 solar eclipse field program. The WSMR profiles have been summarized into monthly profiles. The electron densities derived from utilizing the partial reflection technique appear to be within the expected ranges for D-region profiles. GRA

N81-20645# California Inst. of Tech., Pasadena. Seismological Lab.

BODY AND SURFACE WAVE MODELING OF OBSERVED SEISMIC EVENTS Annual Technical Report, 1 Oct. 1979 - 30 Sep. 1980

David G. Harkrider, Donald V. Helmberger, and J. Bernard Minster 30 Sep. 1980 238 p refs

(Contract F49620-77-C-0022; ARPA Order 3291; AF Proj. 3291)

(AD-A095690; AFOSR-81-0191TR) Avail: NTIS HC A11/MF A01 CSCL 08/11

The research is divided into three main topics, modeling the excitation of surface waves from complex source regions, body wave amplitudes and attenuation across North America, and a technique for separation of multimode dispersion and excitation of observed vertical Lg using arrays. In Section 2 theoretical explosion mechanisms for an all azimuth reversal of Rayleigh wave are presented. In Section 3, a broad band amplitude study of P and SH waves from deep South American events recorded at WWSN stations in the United States provides constraints on upper mantle variations in attenuation. In Section 4, it is shown that Rayleigh type Lg propagation in a laterally homogeneous continental crust can be synthesized by adding only a few overtones at periods greater than 2 sec. Section 5 presents short period P wave amplitude from nuclear explosions in the Soviet Union recorded by WWSSN stations in the United States. GRA

N81-20646# Photometrics, Inc., Lexington, Mass.

AIRCRAFT PROGRAM FOR TARGET, BACKGROUND, AND SKY RADIANCE MEASUREMENTS Final Report, 18 Apr. 1977 - 17 Apr. 1980

Randall B. Sluder, Dennis P. Villanucci, W. Scott Andrus, and Irving L. Kofsky 17 May 1980 27 p refs

(Contract F19628-77-C-0168; ARPA Order 2656; AF Proj. 7670)

(AD-A095363; PHM-01-80; AFGL-TR-80-0165) Avail: NTIS HC A03/MF A01 CSCL 17/8

Aircraft-based measurement, data reduction and instrument construction work performed for the Air Force Geophysics Laboratory in support of AFGL and DARPA sponsored targets characterization and DNA-sponsored nuclear effects simulation programs in the period April 1977 - April 1980 is described and documented. GRA

N81-20647# Keo Consultants, Newton, Mass.

IONIZATION AND EMISSION PROCESSES IN THE AURORAL AND EQUATORIAL IONOSPHERE Final Report, 12 Apr. 1977 - 30 Sep. 1980

Robert H. Eather Hanscom AFB, Mass. AFGL 15 Oct. 1980 50 p refs

(Contracts F19628-77-C-0097; F19628-76-C-0168; AF Proj. 7663)

(AD-A095296; KEO-13; AFGL-TR-80-0326) Avail: NTIS HC A03/MF A01 CSCL 20/6

This report describes the support service supplied by KEO Consultant to the operation, and improvement of the all-Sky-Imaging-Photometer on the NKC-135 Airborne Ionospheric Observatory. Data analysis and results are also described. A new digitizing system constructed to facilitate analysis of video images is described, together with the associated computer software. GRA

N81-20648# Research Inst. of National Defence, Stockholm (Sweden).

INTERNATIONAL SEISMOLOGICAL DATA CENTER: PROCEDURES TO CHECK EVENTS THROUGH DYNAMIC INFORMATION AND TO ESTIMATE MAGNITUDES

Eva Elvers Sep. 1980 39 p refs

(FOA-C-20368-T1) Avail: NTIS HC A03/MF A01

Procedures that utilize dynamic information, such as amplitude data and detection capabilities, not only to estimate the event magnitude by a maximum likelihood method, but also to check events created mainly from arrival times are described. The results of an automatic analysis of data from 60 globally distributed seismological stations during one week of temporary operation are presented. Erroneous data, wrongly associated data, and artificial events were eliminated in many cases by this preliminary version, which argues in favor of a checking procedure. The results also show the importance of adequate detection capabilities and of reporting down periods. Author (ESA)

N81-20649# Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.

MAGNETOSPHERIC SOUNDING ROCKET PROGRAM: THE MAGNETOMETER EXPERIMENT IN THE SUBSTORM PHENOMENA PAYLOAD Final Report

Burkhard Theile and Norbert Kloecker Bonn Bundesministerium fuer Forschung und Technologie Jun. 1980 35 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-W-79-34; ISSN-0170-1339) Avail: NTIS HC A03/MF A01

Four payloads, launched from Norway, were used to measure the magnetic fields associated with field-aligned currents inside the magnetosphere. The relation between particle measurements and the electric field data was investigated. The flights were characterized by different substorm phases: pre-breakup, breakup main phase, and recovery phase. The magnetometer, which is described, performed flawlessly. Some typical results are presented in graphs and discussed. A.R.H.

N81-20650# Bonn Univ. (West Germany). Physikalisches Inst.

A SIMPLE STATIC PHOTOCHEMICAL TRANSPORT MODEL FOR APPLICATION TO THE UPPER ATMOSPHERES OF EARTH, MARS AND VENUS Final Report

Karl-Heinrich Fricke and Ulf vonZahn Bundesministerium fuer Forschung und Technologie Jun. 1980 40 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-W-79-35; ISSN-0170-1339) Avail: NTIS HC A03/MF A01

In order to compare mass spectrometer measurements of the composition of the thermosphere of the Earth with that of other terrestrial planets, model calculations are required, which reflect the influence of photochemical processes and transport on the composition of the thermospheric gas. A computer code was written, which can be easily adapted to the environmental condition of the respective measurement sites. The photochemical model takes the basic reactions in oxygen and carbon dioxide dominated thermospheres under the influence of solar UV radiation into account. The transport model considers molecular diffusion and mixing by eddy diffusion. The model equations are restricted to the vertical dimension and are time independent. Test calculations indicate that such a simplified model reproduces the observed composition in the altitude region of interest for mass spectrometric measurements. Author (ESA)

N81-20651# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.

ELECTRIC FIELDS IN THE MAGNETOSPHERE

Carl-Gunne Faelthammar. Jul. 1980 11 p refs Proposed for presentation at 1982 UN UNISPACE 82 Conf. on Current and Future State of Space Sci., New York
(TRITA-EPP-80-06; ISSN-0348-7539) Avail: NTIS HC A02/MF A01

Recent developments towards gaining a better understanding of the role of electric fields in the magnetosphere are presented. The most important origin of these fields in the solar wind. The Earth's rotation in its own magnetic field is, however, another source of such fields. General characteristics associated with both high and low altitudes are outlined. Emphasis is given to the usefulness of magnetospheric electric field studies in providing some insight into electric field/cosmic plasma interactions and polar aurora phenomena. Future prospects for electric fields measurements are discussed. Author (ESA)

N81-20652# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
A MATHEMATICAL MODEL FOR HOW IONOSPHERIC REFLECTION DEGRADES SEA-ECHO SPECTRA
T. M. Georges and R. M. Jones Jun. 1980 20 p refs
(PB81-108359; NOAA-TM-ERL-WPL-60; NOAA-80081802) Avail: NTIS HC A02/MF A01 CSCL 08C

When sea echo Doppler spectra is measured with a skywave radar, ionospheric irregularities often distort the received signal so much that sea state information cannot be readily extracted. To understand and eventually deal with the distortion, a mathematical model was constructed. It represents the main ionospheric effects as a frequency domain convolution of two more readily modeled quantities: one is the undistorted sea echo amplitude spectrum; the other is an ionospheric path function that is the spectrum (including phase) of a monochromatic transmission over the ionospheric radar paths. GRA

N81-20653# National Oceanic and Atmospheric Administration, Boulder, Colo. World Data Center A for Solar Terrestrial Physics.
AURORAL ELECTROJET MAGNETIC ACTIVITY INDICES AE(12) FOR JULY-DECEMBER 1975
J. H. Allen, C. C. Abston, J. E. Salazar, and J. A. McKinnon Aug. 1980 123 p refs
(PB81-125551; UAG-76; NOAA-80100802) Avail: NTIS HC A06/MF A01 CSCL 04A

The Auroral Electrojet index (AE) is discussed and a brief description is given of the derivation of 12 station 1.0 min AE indices for July - December 1975. Tables are given of hourly average indices for each day of the stations making the main contribution to the hourly indices, and of the average monthly quiet time level of horizontal fields (H) at each magnetic observatory. Graphs of the index variations are included for each day of the second half of 1975 and for the frequency and amplitude of extreme variations at each site. GRA

N81-20654# Naval Research Lab., Washington, D. C.
THE EQUATORIAL LATITUDE OF AURORAL ACTIVITY 1972 - 1977
N. R. Sheeley, Jr., R. A. Howard, and B. S. Dandekar (AFGL, Hanscom AFB, Mass.) Boulder, Colo. NOAA Oct. 1980 70 p refs Sponsored by NOAA
(PB81-132912; UAG-78; NOAA-80102802) Avail: NTIS HC A04/MF A)1 CSCL 04A

Both electron and optical observations with DMSP satellites were used to produce a nearly continuous plot of invariant geomagnetic latitude versus time during the 5 year interval. This plot has two main characteristics: a diurnal variation of approximately + or - 5 degrees which is somehow associated with the precession of the Earth's magnetic dipole axis about the Earth's rotation axis and an irregular variation of roughly 5-10 degrees for intervals of one to several days associated with the occurrence of solar flares and coronal holes. With the help of a condensed, Bartels type display of these measurements, it is concluded that modest auroral expansions occur during the main body of high speed streams from coronal holes and that great expansions occur only during intervals of intense interplanetary magnetic fields, such as may occur at the leading edge of a high speed stream or at a flare produced interplanetary shock. GRA

N81-20968*# National Aeronautics and Space Administration, Washington, D. C.
EARLY HARVEST: THE UPPER ATMOSPHERE AND COSMIC RAYS
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 58-84 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 04A

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N81-20655 Wisconsin Univ. - Madison.
A STUDY OF TOPOGRAPHICALLY-FORCED SURFACE WINDS IN ANTARCTICA WITH SPECIAL EMPHASIS ON THE KATABATIC FLOW AT ADELLE LAND Ph.D. Thesis
Thomas Richard Parish 1980 141 p
Avail: Univ. Microfilms Order No. 8025842

Two simple diagnostic equation systems reflecting the steady state dynamical conditions in the Antarctic hinterland were developed. The diagnostic equations were used to infer the mean surface wind at two interior stations. Vostok and Pionerskaya, where detailed information regarding inversion strength and terrain slope is available. Results of the wind diagnosis were within 1 m/s and 10 degrees of the actual resultant wind. When the diagnosis was extended to the entire continent, a time averaged winter flow pattern was generated. Such flow patterns were deemed representative. Adequate diagnosis of the persistent Antarctic interior winds is possible with very simple steady state equation systems. Dissert. Abstr.

N81-20656 Johns Hopkins Univ., Baltimore, Md.
POINT PROCESS MODELS OF RAINFALL Ph.D. Thesis
James Anderson Smith 1981 193 p
Avail: Univ. Microfilms Order No. 8106648

Point process models of summer rainfall for the Potomac River basin are developed for application to streamflow prediction during drought periods. The point process models that are developed include: (1) a univariate point process model of rainfall occurrences at a site; (2) a marked point process model of rainfall occurrences and storm depths at a site; and (3) a bivariate point process model of rainfall occurrences at two sites. The univariate point process model of rainfall occurrences, which is denoted an RCM process (for Renewal Cox process with Markovian intensity), can be described as a point process for which the rate of occurrence of events alternates randomly between two states, one of which is 0, the other positive. The form of the RCM process suggests an interpretation of clustering of rainfall occurrences based on the alternation of wet and dry periods.
Dissert. Abstr.

N81-20657 Colorado Univ. at Boulder.
THUNDERCLOUD LOCAL ELECTRIC FIELD INTENSIFICATION DURING THE PRE-BREAKDOWN PHASE OF LIGHTNING Ph.D. Thesis
Jose Ricardo Santos deSouza 1980 206 p
Avail: Univ. Microfilms Order No. 8103085

The time and space evolution of the electric fields, conductivity, and charge densities associated with the buildup and decay of secondary charge inhomogeneities SCI in thunderclouds are estimated. It is assumed that the rapid development of a SCI can be explained in terms of three classes of charger carriers: the precipitating negatively charged hydrometeors plus the positive and negative small ions. Several theoretical pulse shapes of the precipitation current were modelled using estimated values for the charging current between lightning flashes and the observed current density variations in time. The computed results indicate that when current sources, with maxima between 1 and 10 amperes and pulses wider than 5 sec originate a spherically symmetric SCI the electric field may be locally intensified to 1 mil v/m or more. The electric fields, charge densities, and conductivities grow and decay within a short time relative to the thundercell evolution interval. Dissert. Abstr.

N81-20658*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE PRESIDENT'S DAY CYCLONE 17-19 FEBRUARY 1979: AN ANALYSIS OF JET STREAK INTERACTIONS PRIOR TO CYCLOGENESIS
Louis W. Uccellini, Paul J. Kocin, and Carlyle H. Walsh (Wisconsin Univ., Madison) Jan. 1981 67 p refs
(NASA-TM-82077) Avail: NTIS HC A04/MF A01 CSCL 04B

The President's Day cyclone, produced record breaking snowfall along the East Coast of the United States in February 1979. Conventional radiosonde data, SMS GOES infrared imagery and LFM 2 model diagnostics were used to analyze the interaction of upper and lower tropospheric jet streaks prior to cyclogenesis. The analysis reveals that a series of complex scale interactive processes is responsible for the development of the intense cyclone. The evolution of the subsynoptic scale mass and momentum fields prior to and during the period of rapid development of the President's Day cyclone utilizing conventional data and SMS GOES imagery is documented. The interaction between upper and lower tropospheric jet streaks which occurred prior to the onset of cyclogenesis is discussed as well as the possible effects of terrain modified airflow within the precyclogenesis environment. Possible deficiencies in the LFM-2 initial wind fields that could have been responsible, in part, for the poor numerical forecast are examined. A.R.H.

N81-20659# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DAILY SURFACE PRESSURE VARIATIONS IN BRAZIL: THEIR SPATIAL DISTRIBUTIONS, ORIGINS AND EFFECTS
Vernon E. Kousky and Nelson J. Ferreira Dec. 1980 41 p refs Submitted for publication
(INPE-1974-RPE/279) Avail: NTIS HC A03/MF A01

The spatial correlation of daily surface pressure variations in Brazil are studied. Pressure oscillations that occur in southern Brazil, associated with midlatitude synoptic systems, are correlated with pressure oscillations near the equator. The correlation maxima show on eastward displacement with increasing lag. Interannual variability in the correlation coefficients is discussed and related to variability in the intensity and frequency of midlatitude systems which effect the region. Some Southern Hemisphere synoptic systems have a marked effect on convective activity eastward displacement with time. A principal component analysis reveals that only the patterns of the first three eigenvectors have readily identifiable causes. These are associated with the annual pressure cycle, and typical wintertime and summertime patterns. The corresponding eigenvalues explain approximately 80% of the total variance. Author

N81-20660# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
UPPER TROPOSPHERIC CYCLONIC VORTICES IN THE TROPICAL SOUTH ATLANTIC
Vernon E. Kousky and Manoel A. Gan Nov. 1980 39 p refs Submitted for publication
(INPE-1946-RPE/263) Avail: NTIS HC A03/MF A01

The cyclones were observed to occur primarily during the summer months and generally form near the axes of the mid-oceanic troughs. The relationship between cyclone formation and the presence of 200 mb anticyclones over the continental areas is discussed. Processes for cyclone formation were considered. The cyclones were characterized by a cold core and a direct thermal circulation - the cold air sinking and warm air on the periphery rising. The cloud pattern associated with the cyclones were found to depend on the direct thermal circulation, the vortex location and its direction of movement. The effects of South Atlantic 200 mb cyclonic vortices on Brazil's weather are discussed. T.M.

N81-20661# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Dept. of Meteorology.
DIABATIC WIND PROFILE AND ITS RELATION TO THE SCALE OF TURBULENCE
Y. Viswanadham and Maria Tereza C. Nogueira Dec. 1980 27 p refs Submitted for publication
(INPE-1966-RPE/277) Avail: NTIS HC A03/MF A01

Wind profiles observed at various locations are used to examine the diabatic wind profile formulation on the basis of the similarity theory and scale of turbulence. Theory and observations agree well for various thermal stratification conditions. In conditions of very high stability, a linear profile is suggested. In quasineutral conditions, a log linear formulation is found to give an adequate description of the wind profile. S.F.

N81-20662# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
STEPWISE LINEAR REGRESSION EXPERIMENTS IN 14 AND 19 DAY HEMISPHERIC WEATHER PREDICTION
Srinivasam Srivatsangam Nov. 1980 25 p refs Presented at Intern. Symp. on Statist. Weather Predictions, Nice, 6-12 Sep. 1980
(INPE-1948-RPE/265) Avail: NTIS HC A02/MF A01

The zonal variance of the heights of constant pressure surfaces in the atmosphere is taken to be Markovian, i.e., unpredictable over long times by its own history. It is shown through cross correlation and multiple regression that the zonal variance is predictable over long times at a given location, through its lagged cross correlation at other locations. Author

N81-20663# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ATMOSPHERIC OZONE MEASUREMENTS IN BRAZIL DATA BULLETIN NO. 1, 1974 - 1976
Y. Sahai and N. R. Teixeira Jan. 1981 18 p refs
(INPE-1985-RPE/282) Avail: NTIS HC A02/MF A01

Regular measurements of the total content of the atmospheric ozone, were carried out at Cachoeira Paulista (22 deg 41'19"S, 45 deg 00'22"W; altitude 573 m), Brazil. When conditions permitted, observations for vertical ozone profile were made. Data of total amount of ozone for the triennial 1974-1976 are presented. S.F.

N81-20664*# Tennessee Univ. Space Inst., Tullahoma. Atmospheric Science Div.
ANALYSIS OF THE INVERSION MONITORING CAPABILITIES OF A MONOSTATIC ACOUSTIC RADAR IN COMPLEX TERRAIN Final Report
David Koepf and Walter Frost Washington NASA Apr. 1981 61 p refs
(Contract NAS8-32031)
(NASA-CR-3401) Avail: NTIS HC A04/MF A01 CSCL 04B

A qualitative interpretation of the records from a monostatic acoustic radar is presented. This is achieved with the aid of airplane, helicopter, and rawinsonde temperature soundings. The diurnal structure of a mountain valley circulation pattern is studied with the use of two acoustic radars, one located in the valley and one on the downwind ridge. The monostatic acoustic radar was found to be sufficiently accurate in locating the heights of the inversions and the mixed layer depth to warrant use by industry even in complex terrain. Author

N81-20665*# ESPEE, Inc., Huntsville, Ala.
A STATISTICAL DATA ANALYSIS AND PLOTTING PROGRAM FOR CLOUD MICROPHYSICS EXPERIMENTS Final Contractor Report
Archie J. Jordan 25 Feb. 1981 145 p refs
(NASA Order H-43036B)
(NASA-CR-161663; SP-81-04) Avail: NTIS HC A07/MF A01 CSCL 04B

The analysis software developed for atmospheric cloud microphysics experiments conducted in the laboratory as well as aboard a KC-135 aircraft is described. A group of four programs was developed and implemented on a Hewlett Packard 1000 series F minicomputer running under HP's RTE-IVB operating system. The programs control and read data from a MEMODYNE Model 3765-8BV cassette recorder, format the data on the Hewlett Packard disk subsystem, and generate statistical data (mean, variance, standard deviation) and voltage and engineering unit plots on a user selected plotting device. The programs are written in HP FORTRAN IV and HP ASSEMBLY Language with the graphics software using the HP 1000 Graphics. The supported plotting devices are the HP 2647A graphics terminal, the HP 9872B four color pen plotter, and the HP 2608A matrix line printer. Author

N81-20666*# Science Applications, Inc., Huntsville, Ala.
WIND PROFILES FOR SPACE SHUTTLE LOADS ANALYSIS Final Report
Stanley I. Adelfang 29 Dec. 1978 75 p refs
(Contract NAS8-32839)
(NASA-CR-161676; SAI-79-819-HU) Avail: NTIS HC A04/MF A01 CSCL 04B

The small scale wind velocity perturbations in vertical wind profiles at Cape Kennedy, Florida were analyzed in order to derive information for simulations of space shuttle ascent through the perturbed atmosphere. The available statistical data does not permit specification of various aspects of idealized singularities and wavelike perturbations with a reasonable degree of confidence. The information developed as a result of the analysis described in Section 3 of this report is suitable for the further development of idealized models. The term perturbation is used instead of the more common term, gust. According to the conventional approach, a gust profile is calculated by applying a high pass digital filter to a Jimsphere profile; all the speeds in the filtered profile are defined as gusts. The high pass filtered profile is defined as a residual profile and the maximum residual in the vicinity of a specified reference height is defined as the gust. Gusts defined in this manner represent the perturbation peaks. A detailed discussion of the calculation of residual profiles and gusts is given. The meteorological coordinate system, the data sample, and Jimsphere profiles are also described. Recommendations and conclusions are presented. J.M.S.

N81-20667*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SUMMARY OF JIMSPHERE WIND PROFILES: PROGRAMS, DATA, COMMENTS, PART 1 Final Report
Joseph A. Willett 1 Mar. 1979 300 p
(Contract NAS8-32432)
(NASA-CR-161664) Avail: NTIS HC A13/MF A01 CSCL 04B

Jimsphere wind profiles are documented for the following ranges and installations: Eastern Test Range, Cape Kennedy, Florida; Western Test Range; Point Mugu, California; White Sands Missile Range, New Mexico; Wallops Island, Virginia; Green River, Utah; and Vandenberg Air Force Base, California. Profile information for 1964-1977 includes data summaries, computer formats, frequency distributions, composite listings, etc., for use in establishing and interpreting natural environment criteria for aeronautical vehicle design and engineering operations. J.M.S.

N81-20668*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE 1980 DIRECT STRIKE LIGHTNING DATA
Felix L. Pitts and Mitchel E. Thomas Feb. 1981 45 p refs
(NASA-TM-81946) Avail: NTIS HC A03/MF A01 CSCL 04B

Data waveforms are presented which were obtained utilizing the NASA F-106B aircraft specially instrumented for lightning electromagnetic measurements. The aircraft was operated in a thunderstorm environment to elicit strikes. Concurrently recorded electric and magnetic field and lightning current data were obtained. T.M.

N81-20669# Rice Univ., Houston, Tex.
BALLOON ELECTRICAL ENVIRONMENT PROFILING SYSTEM (BEEPS) Final Report
Arthur A. Few, Jr. Dec. 1980 13 p
(Contract N00014-77-C-0154)
(AD-A095531) Avail: NTIS HC A02/MF A01 CSCL 04/2

The Balloon Electrical Environment Profiling Systems (BEEPS), was envisaged as a sensory system that could be utilized to obtain a vertical profile of the complete set of atmosphere electrical parameters: (1) vector electric fields, conduction currents, and conductivity. Other objectives were to use high-technology in the design and produce a small system that could be easily launched. All of these design objectives have been met. The experimental objectives utilizing the systems developed in the program were to obtain atmospheric electrical data in the arctic, where solar-activity perturbations to the upper atmosphere of an electrical nature are known to occur. This objective has likewise been met: two BEEPS were launched from the Naval Arctic Research Laboratory (NARL) at Point Barrow, Alaska. The scientific goal of finding an electrical coupling between solar activity and tropospheric weather cannot be achieved with two balloon flights but this program has demonstrated the capability of the BEEPS for acquiring the necessary data to test electrical coupling mechanisms within the lower atmosphere. GRA

N81-20670# Systems and Applied Sciences Corp., Riverdale, Md.
PERFORMANCE OF THE DISCRETE FOURIER TRANSFORM SATELLITE IMAGERY CLASSIFICATION TECHNIQUE
Robert P. dEntremont 17 Jun. 1980 76 p refs
(Contract F19628-79-C-0033; AF Proj. 6670)
(AD-A095364; SCIENTIFIC-3; AFGL-TR-80-0175) Avail: NTIS HC A05/MF A01 CSCL 05/8

The discrete Fourier transform (DFT) automated satellite imagery classification technique is designed to detect and identify cloud features from 25 x 25 nautical mile (nm) Defense Meteorological Satellite Program (DMSP) visible and infrared imagery samples. The DFT classifier performs two basic steps: feature extraction and sample identification. The feature extraction technique reduces and compresses the original visible and infrared data of an imagery sample in order to retain only the information needed to determine the cloud type of that sample. A multivariate normal density discriminant function then uses this information to identify the cloud type of the image sample from nine possible classes. The results obtained through this experiment show that the classifier can provide accurate and reliable cloud type classifications of satellite imagery samples. This report presents a detailed mathematical description of the DFT spectral classifier technique and offers some ideas for future modifications to the classifier. GRA

N81-20671# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO), LAJES FLD, TERCEIRA, AZORES, PARTS A-F Final Report
14 Nov. 1980 416 p
(AD-A095330; AD-E850012; USAFETAC/DS-81/006) Avail: NTIS HC A18/MF A01 CSCL 04/2

This report is a six part statistical summary of surface weather observations for Lajes Fld, Terceira, Azores. It contains the following parts: (A) weather conditions, atmospheric phenomena, (B) precipitation, snowfall and snow depth (daily amounts, and extreme values), (C) surface winds, (D) ceiling versus visibility; sky cover; (E) psychrometric summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew point temperatures and relative humidity), and (F) pressure summary (means, standard deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurring tables. GRA

N81-20672# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
DAVISON AAF, FT. BELVOIR VIRGINIA, REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO), PARTS A-F Final Report
8 Dec. 1980 478 p
(AD-A095332; AD-E850014; USAFETAC/DC-81/008) Avail: NTIS HC A21/MF A01 CSCL 04/2

This report is a six part statistical summary of surface weather observations for Davison AAF, Ft. Belvoir, Virginia. It contains the following parts: (A) weather conditions, atmospheric phenomena, (B) precipitation, snowfall and snow depth (daily amounts, and extreme values), (C) surface winds, (D) ceiling versus visibility, sky cover; (E) psychrometric summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew point temperatures and relative humidity), and (F) pressure summary (means, standard deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of

occurrence or cumulative percentage frequency of occurring tables. GRA

N81-20673# Air Force Environmental Technical Applications Center, Scott AFB, Ill.

HICKAM AFB, HONOLULU, HAWAII, REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO), PARTS A-F Final Report

21 Nov. 1980 416 p

(AD-A095331; AD-E850013; USAFETAC/DS-81/007-Pt-A-F) Avail: NTIS HC A18/MF A01 CSCL 04/2

This report is a six part statistical summary of surface weather observations for Hickam AFB, Honolulu, Hawaii. It contains the following parts: (A) weather conditions, atmospheric phenomena, (B) precipitation, snowfall and snow depth (daily amounts, and extreme values), (C) surface winds, (D) ceiling versus visibility, sky cover; (E) psychrometric summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew point temperatures and relative humidity), and (F) pressure summary (means, standard deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occuring tables. GRA

N81-20674# Air Force Environmental Technical Applications Center, Scott AFB, Ill.

REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO), MAUI OPTICAL SITE, MOUNT HALEKULIA, HAWAII, PARTS C, E-F Final Report

23 Sep. 1980 455 p

(AD-A095328; AD-E850010; USAFETAC/DS-81/004) Avail: NTIS HC A20/MF A01 CSCL 04/2

This report is a six part statistical summary of surface weather observations for Maui Optical Site, Mt. Halikualia, Hawaii. It contains the following parts (A) weather conditions, atmospheric phenomena, (B) precipitation, snowfall and snow depth (daily amounts, and extreme values), (C) surface winds, (D) ceiling versus visibility, sky cover; (E) psychrometric summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew point temperatures and relative humidity), and (F)pressure summary (means, standard deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence cumulative percentage frequency of occuring tables. GRA

N81-20675# Air Force Environmental Technical Applications Center, Scott AFB, Ill.

PORTLAND IAP, PORTLAND, OREGON, REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO), PARTS A-F Final Report

8 Sep. 1980 433 p

(AD-A095329; AD-E850011; USAFETAC/DS-81/005) Avail: NTIS HC A19/MF A01 CSCL 04/2

This report is a six part statistical summary of surface weather observations for Portland, Oregon. It contains the following parts: (A) weather conditions, atmospheric phenomena, (B) precipitation, snowfall and snow depth (daily amounts, and extreme values), (C) surface winds, (D) ceiling versus visibility; sky cover; (E) psychrometric summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew point temperatures and relative humidity), and (F)pressure summary (means, standard deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occuring tables. GRA

N81-20676# Calspan Corp., Buffalo, N. Y.

FOG CHARACTERISTICS AT OTIS AFB, MASSACHUSETTS Final Report, 1 Jan. - 30 Sep. 1980

E. J. Mack, B. J. Wattle, C. W. Rogers, and R. J. Pillie Hanscom AFB, Mass. AFGL Oct. 1980 83 p refs

(Contract F19628-80-C-0041; AF Proj. 6670)

(AD-A095358; CALSPAN-6655-M-1; AFGL-TR-80-0340) Avail: NTIS HC A05/MF A01 CSCL 04/2

Measurements of the microphysical characteristics of fog occurring at Otis AFB (Cape Cod) were obtained during a three-week field study in July 1980. Measurements of dew deposition, CCN and pre-fog aerosol size spectra and samples of aerosols for composition analysis were also acquired. Results of the analyses and limited interpretation of the data are presented. GRA

N81-20677# Department of Energy, Oak Ridge, Tenn. Technical Information Center.

CARBON DIOXIDE AND CLIMATE: A BIBLIOGRAPHY

Oct. 1980 104 p

(DOE/TIC-3382) Avail: NTIS HC A06/MF A01

Abstracts of 394 citations cover all aspects of the climatic effects of carbon dioxide emissions to the atmosphere. These include carbon cycling, temperature effects, carbon dioxide control technologies, paleoclimatology, carbon dioxide sources and sinks, mathematical models, energy policies, greenhouse effect, and the role of the oceans and terrestrial forests. DOE

N81-20678# California Univ., Livermore.

COMPARISON OF WIND SPECTRA FROM SPATIALLY AVERAGED AND POINT MEASUREMENTS IN COMPLEX TERRAIN

W. M. Porch Sep. 1980 4 p refs Presented at the 5th Symp. on Turbulence, Diffusion and Air Pollution, Atlanta, 9-13 Mar. 1981 Sponsored by the AMS

(Contract W-7405-eng-48)

(UCRL-84546; ASCOT-80-4; CONF-810306-4) Avail: NTIS HC A02/MF A01

Results are reported for two experiments in complex terrain where a single light path was used across a valley. These experiments were conducted in two regions of California during the same month on different years. The regions differed significantly in their meteorological regimes. Comparison of the normalized autospectral densities of the spatially averaged and point wind measurements showed similar behavior for periods longer than four hours. For periods shorter than four hours the spectra diverge with different slopes for both region's data. This divergence at this relatively low frequency was found to be associated more with wind direction than wind speed changes. DOE

N81-20679# Battelle Pacific Northwest Labs., Richland, Wash.

COMPARISON OF OBSERVED AND PREDICTED SLOPE WINDS

T. W. Horst and J. C. Doran Jul. 1980 12 p refs Presented at the ASCOT Field Study, Gettysburg, Pa., 15-18 Apr. 1980

(Contract DE-AC06-76RL-01830)

(PNL-SA-8785; CONF-800480-6) Avail: NTIS HC A02/MF A01

Nocturnal drainage winds begin when air adjacent to an inclined surface flows down the slope because it is cooled more than the free air at some distance horizontally from the surface. These slope winds merge and are channeled by the topography to form the larger-scale drainage or mountain winds. The slope flow phase of the drainage wind is discussed. The predictions of a simple model for flow down a two dimensional slope are compared to observations of the drainage wind obtained during the July 1979 ASCOT field study near Middletown, CA. DOE

N81-20680# SRI International Corp., Menlo Park, Calif.

CONSULTATION FOR THE H2S AND METEOROLOGICAL MONITORING PROGRAM OF THE ENTE NAZIONAL PER L'ENERGIA ELECTTRICA (ENEL) Final Report

Ronald E. Ruff, Leonard A. Cavanagh, and Ronald T. H. Collis May 1980 29 p

(Contract DE-AT03-76ET-28502)

(DOE/ET-28502/1) Avail: NTIS HC A03/MF A01

Assistance in setting up a program for monitoring air quality in the vicinity of geothermal development in Larderello's vapor-dominated fields is reviewed. DOE

N81-20681# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Optoelektronik.

MEASUREMENTS OF LIDAR BACKSCATTERING FROM CLOUDS

Egmont Wolff Jul. 1980 96 p refs In GERMAN; ENGLISH summary Report will also be announced as ESA translation (ESA-TT-689)

(DFVLR-Mitt-80-12) Avail: NTIS HC A05/MF A01

The operating principles, main elements (laser and detectors), and theoretical characteristics of a lidar system are described. Online data acquisition facilities are discussed. Two telescopes are used simultaneously to receive the parallel and perpendicular components of the polarized cloud backscatter signatures. Details are given on calibrating the system and on how to distinguish between ice and water clouds from polarization measurements. Depolarization and multiple scattering effects are discussed, some examples being given. Author (ESA)

N81-20682# National Oceanic and Atmospheric Administration, Miami, Fla. Research Facilities Center.

IN-FLIGHT CALIBRATION OF THE NOAA/RFC METEOROLOGICAL RESEARCH AIRCRAFT INSTRUMENTS AT THE AIR FORCE EASTERN TEST RANGE, 1977 - 1978

F. J. Merceret, H. Davis, R. DeVivo, W. M. Lewis, W. D. Mallinger, and J. A. Zysko Sep. 1980 69 p

(PB81-132771; NOAA/TM/ERL/RFC-6; NOAA-80110407) Avail: NTIS HC A04/MF A01 CSCL 04B

In-flight calibrations of the meteorological research aircraft at the Air Force Eastern Test Range during 1977 and 1978 are described. Results relating to the accuracy of selected meteorological instrumentation on the aircraft are presented. The instruments calibrated were the temperature, humidity and pressure sensors, the radar altimeters, and the wind finding system. GRA

N81-20009# Technische Universitaet, Brunswick (West Germany). Lehrstuhl fuer Flugmechanik.

DIGITAL FILTERING OF PCM-RECORDED FLIGHT DATA FOR WIND-PROCESSING

M. Swolinsky and P. Voersmann *In* DFVLR On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 35-64 refs In GERMAN; ENGLISH summary (For primary document see N81-20007 11-01)

Avail: NTIS HC A16/MF A01

N81-20010# National Aerospace Lab., Amsterdam (Netherlands).

ON THE USE OF AIDS-DATA FOR A STATISTICAL ANALYSIS OF WIND SHEAR DURING THE APPROACH

H. Haverdings *In* DFVLR On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 65-94 refs (For primary document see N81-20007 11-01)

Avail: NTIS HC A16/MF A01

N81-20011# Technische Universitaet, Brunswick (West Germany). Lehrstuhl fuer Flugmechanik.

WIND SHEAR MEASURING ON BOARD AN AIRLINER

P. Krauspe *In* DFVLR On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 95-119 refs In GERMAN; ENGLISH summary Sponsored by Deutsche Forschungsgemeinschaft (DFG) (For primary document see N81-20007 11-01)

Avail: NTIS HC A16/MF A01

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N81-20683 Virginia Univ., Charlottesville.

BOUNDARY-LAYER STRUCTURE OVER THE TROPICAL OCEAN Ph.D. Thesis

David Roy Fitzjarrald 1980 191 p

Avail: Univ. Microfilms Order No. 8101045

The vertical thermodynamic and wind structure of the topical boundary layer was studied using a large number of detailed tethered balloon soundings. The ratio of the transition layer thickness to the mixed layer thickness (d/H) was found to decrease from 0.5 to 0.2 as H varied from 100 to 800 m, in accordance with predictions of a simple overshooting plume model. Mixed layers observed during disturbed periods (H approximately 300 m) were shallower and cooler than those observed during undisturbed periods (H approximately 500 m). During periods of light (heavy) rain the disturbed mixed layers were moister (drier) than the undisturbed mixed layers. Disturbed periods were characterized by nearly constant relatively cool temperatures at 8 m. Recovery to undisturbed conditions took from 2 to 8 hr. Mixed layer growth strongly affected humidity and temperature in the surface layer. Dissert. Abstr.

N81-20684 Florida State Univ., Tallahassee.

MIXING, CONVECTION, AND ADVECTION IN THE UPPER OCEAN Ph.D. Thesis

Benoit Cushman-Roisin 1980 212 p

Avail: Univ. Microfilms Order No. 8106265

Convection, mixing, and advection in the upper ocean may be thought of as the motion of two interacting fluids of different properties: the sinking fluid parcels generated near the surface and transmitting surface information downward, and the compensating rising return flow. A theory based on this concept is developed and applied to deepening of the wind-mixed layer, penetrative convection due to surface cooling, and upper-ocean frontogenesis due to horizontal advection. Equations of the general theory are written for two interacting Boussinesq fluids in a rotating frame. Interaction terms are parametrized in order to apply the theory to geophysical situations. Although the applications focus on the upper ocean, the theory is general and also applied to the lower atmosphere. Dissert. Abstr.

N81-20685 Columbia Univ., New York.

SOME LARGE SCALE ASPECTS OF THE SOUTHERN OCEAN AND ITS ENVIRONMENT Ph.D. Thesis

Hoyt Weston Taylor 1980 164 p

Avail: Univ. Microfilms Order No. 8105106

The wind stress upon the sea surface at 5 deg x 5 deg latitude and longitude grid points is presented over the entire Southern Ocean. The dependent parameters of Ekman Transport, wind stress curl, upwelling velocity at the base of the Ekman layer, and Sverdrup Transport are also presented. The distribution of the resulting quantities is discussed and compared to many similar geographical trends of the oceanographic data. The question of cause and effect, in particular reference to the oceanic polar front, is presented. The Ekman Transport and resulting upwelling values are then put to use in conjunction with heat budget data, in an effort to explain the high gradients of the polar front by the local sea-air flux of heat and momentum. The expected gradients are opposite to those observed. The high gradients of the polar front zone are then a cause of the observed heat budget in that vicinity, rather than a result, with the conclusion that the surface ocean is forced on a larger scale in connection with the deep ocean, and the Antarctic Circumpolar Current. Dissert. Abstr.

N81-20686*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SATELLITE ALTIMETRIC MEASUREMENTS OF THE OCEAN. REPORT OF THE TOPEX SCIENCE WORKING GROUP

Robert Stewart 1 Mar. 1981 88 p refs

(Contract NAS7-100)

(NASA-CR-164087; JPL-PUB-81-4) Avail: NTIS HC A05/MF A01 CSCL 08C

The scientific usefulness of satellite measurements of ocean topography for the study of ocean circulation was investigated. The following topics were studied: (1) scientific problems which use altimetric measurements of ocean topography; (2) the extent in which in situ measurements are complementary or required; (3) accuracy, precision, and spatial and temporal resolutions which are required of the topographic measurements; (4) errors associated with measurement techniques; and (5) influences of these errors on scientific problems. An operational system for measuring ocean topography, was defined and the cost of conducting such a topographic experiment, was estimated.

E.A.K.

N81-20687# Naval Research Lab., Washington, D. C.

BREAKING SOLUTIONS OF THE VARIABLE COEFFICIEN

KORTEWEG-DEVRIES EQUATION Interim Report
M. S. Cramer (Virginia Polytechnic Inst. and State Univ.), B. McCown, and M. E. Bowman 23 Feb. 1981 33 p refs (RR0310341)
(AD-A095247; NRL-MR-4444) Avail: NTIS HC A03/MF A01 CSCL 12/1

Strongly shoaling solutions to the variable coefficient Korteweg-de Vries depth variations. These solutions are valid when eta<<delta<< 1, where eta is the ratio of the initial wave amplitude to the depth and delta is the ratio of the initial length of the wave to the length scale associated with the depth variation. The conditions at breaking are given in terms of the initial shape of the wave and the depth variation. An equation for the actual wave amplitude at breaking was found. Numerical solutions of the equation were obtained and were in excellent agreement with the asymptotic results. GRA

N81-20688# Environmental Research Inst. of Michigan, Ann Arbor. Applications Div.
COASTAL REMOTE SENSING INVESTIGATIONS. VOLUME 2: BEACH ENVIRONMENT Final Technical Report
Eric S. Kasischke Dec. 1980 96 p refs
(Contract N00014-78-C-0458)
(AD-A095692; ERIM-134400-11-F-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 17/5

An algorithm was developed which first classifies beach sands into one of five mineralogical classifications, then estimates grain size and soil moisture using equations based on actual and AQUASAND data. This algorithm was evaluated using 'unknown' beach sand samples. The algorithm correctly identified the beach mineralogy in three out of the six cases, and the soil moisture estimates were in good agreement with the correctly predicted grain size. The algorithm was modified to classify airborne multispectral scanner data from two test sites (Lake Michigan and Panama City, Florida). This report also contains sections on the use of satellite data as inputs into the MOGS algorithm and the development of similar algorithms for soils other than sand. GRA

N81-20689# Hawaii Univ., Honolulu. James K. K. Look Lab. of Oceanographic Engineering.
CURRENT-WAVE SPECTRA COUPLING PROJECT, VOLUME 4. PART A: FORMULATION OF THE THREE-DIMENSIONAL STRUCTURE OF STORM-GENERATED CURRENTS. PART B: SUMMARIES OF VOLUMES 1, 2 AND 3
Giulio Venezian (Texas A and M Univ.) and Charles L. Bretschneider Sep. 1980 191 p refs 4 Vol.
(Contract DE-AT03-76SF-20235)
(DOE/SF-20235/T1-Vol-4; Rept-80-1-A-B) Avail: NTIS HC A09/MF A01

An attempt is made to formulate the technical approach to the problem of three dimensional wind driven currents under hurricane conditions. The approach, although not entirely satisfactory, seems to be an improvement on the work by Forristall, but this remains to be verified with future work, including the use of measured data. An improvement could be made if there were some better way of representing the shear stress as a function of the wind velocity (wind speed and direction). It seems that the wind velocity relative to the water motion is what matters, but in turbulent flow the surface value is not well defined. This difficulty leaves one with an unbalanced vortex stretching which accounts for the spin up of the fluid, but the details of that are lacking. Essentially, it appears that it is feasible to modify Forristall's approach to obtain a more realistic representation of the structure of the boundary layer to take into account the turbulent nature of the flow. DOE

N81-20690# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
HF (HIGH FREQUENCY) RADAR MEASUREMENTS OF CIRCULATION IN THE EASTERN STRAIT OF JUAN DE FUCA NEAR PROTECTION ISLAND (JULY 1979) Final Report
Shelby Frisch Jun. 1980 143 p Sponsored in part by EPA
(PB81-127490; EPA-600/7-80-129) Avail: NTIS HC A07/MF A01 CSCL 08C

The surface currents in the Eastern Strait of Juan de Fuca were mapped with a High Frequency radar system (CODAR). These currents were measured simultaneously over several hundred square kilometers continuously for five days. The strong tidal currents and estuarine flow dominated the circulation during most of the period of time, while the relatively weak winds seemed to play a minor role. The radar sites were selected to provide ocean current information along the proposed pipelines. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N81-20691*# National Aeronautics and Space Administration, Washington, D. C.
THE EFFECT OF IMMOBILIZATION AND 3 (BETA-AMINOETHYL)-1, 2, 4 TRIAZOL ON THE CALCIUM CONTENT IN GASTRIC TISSUES OF GUINEA PIGS DURING THE FORMATION OF EXPERIMENTAL ULCERS
L. L. Grechishkin and K. Ritling Jun. 1980 8 p refs Transl. into ENGLISH from Farmakol. Toksikol. (USSR), v. 39, no. 1, 1976 p 86-89 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Academy of Medical Sciences Inst. for Experimental Medicine, Leningrad
(Contract NASw-3199)
(NASA-TM-75992) Avail: NTIS HC A02/MF A01 CSCL 06C

A sharp fall in the concentration of calcium in gastric tissues upon immobilization and after administration of the histamine analog was recorded. Similar shifts were seen to occur in the blood plasma as well. This implies that under the effect of different action, tissue dystrophy develops by following a common mechanism involving not only the adenyl cyclase system, but that of calcium ion metabolism as well. The calcium ion content in the blood plasma and gastric tissues were measured by atomic absorption spectrophotometry. T.M.

N81-20692*# National Aeronautics and Space Administration, Washington, D. C.
ISLET IN WEIGHTLESSNESS: BIOLOGICAL EXPERIMENTS ON BOARD COSMOS 1129 SATELLITE
Yu. Zhuk Sep. 1980 7 p Transl. into ENGLISH from Izv. (Moscow), no. 228 (19293), 29 Sep. 1979 p 3, col. 1-3 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76396) Avail: NTIS HC A02/MF A01 CSCL 06C

Biological experiments planned as an international venture for COSMOS 1129 satellite include tests of: (1) adaptation of rats to conditions of weightlessness, and readaption to Earth's gravity; (2) possibility of fertilization and embryonic development in weightlessness; (3) heat exchange processes; (4) amount of gravity force preferred by fruit flies for laying eggs (given a choice of three centrifugal zones); (5) growth of higher plants from seeds; (6) effects of weightlessness on cells in culture and (7) radiation danger from heavy nuclei, and electrostatic protection from charged particles. Author

N81-20693*# National Aeronautics and Space Administration, Washington, D. C.
THE ROLE OF ACTH AND GLUCOCORTICOIDS IN NONENZYMATIC FIBRINOLYSIS DURING IMMOBILIZATION STRESS IN ANIMALS
B. A. Kudryashov, F. B. Shapiro, E. G. Lomovskaya, and L. A. Lyapina Jun. 1980 14 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (USSR), v. 63, no. 5, 1977 p 735-741 Original language document was announced as A75-31019 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Moscow State Univ., (USSR)
(Contract NASw-3198)
(NASA-TM-76175) Avail: NTIS HC A02/MF A01 CSCL 06C

The role of the altered hormonal status of an organism in the activation of the anticoagulative system during stress is investigated. The 30 minute immobilization stress was shown to raise significantly the nonenzymatic fibrinolytic activity of blood in rats. Combined with adrenocorticotropin (ACTH) the effect is

still greater. Intravenous administration of 0.2 m1 0.01 percent solution of protamine sulphate prevented the nonenzymatic fibrinolysis induced by the stress. Administration of ACTH after protomine sulphate again raised the fibrinolysis. This suggests that ACTH stimulates the release of heparin. M.G.

N81-20694*# National Aeronautics and Space Administration, Washington, D. C.

CHANGES IN MAST CELLS AND IN PERMEABILITY OF MESENTERIC MICROVESSELS UNDER THE EFFECT OF IMMOBILIZATION AND ELECTROSTIMULATION

M. P. Gorizontova Jun. 1980 8 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), no. 2, 1974 p 73-76 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-2790)
(NASA-TM-75988) Avail: NTIS HC A02/MF A01 CSCL 06C

It was shown that a reduction in the amount of mast cells in the mesentery and an increase in their degranulation was accompanied by an increase in vascular permeability of rat mesentery. It is supposed that immobilization and electrostimulation causing degranulation of mast cells prompted histamine and serotonin release from them, thus increasing the permeability of the venular portion of the microvascular bed. Prophylactic use of esculamin preparation with P-vitaminic activity decreased mast cell degranulation, which apparently prolonged the release of histamine and serotonin from them and normalized vascular permeability. T.M.

N81-20695*# National Aeronautics and Space Administration, Washington, D. C.

MORPHOLOGICAL CHANGES IN NEURONS OF THE HIND LIMB REFLEX ARC DURING LONG TERM IMMOBILIZATION

Z. Ya. Tkachenko Jun. 1980 6 p Transl. into ENGLISH from Fiziol. Zh., Akad. Nauk. Ukrainskiy SSR (USSR), v. 9 no. 3, 1963 p 383-384 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Inst. of Physiology, Academy of Sciences, Kiev
(Contract NASw-3199)
(NASA-TM-75939) Avail: NTIS HC A02/MF A01 CSCL 06C

Twelve adult rabbits were immobilized for 9 to 31 days, followed by histological study of the nerve processes of lumbar vertebra 7 and sacral vertebra 1, the sciatic nerve and the motor endings of the thigh muscles. In the spinal ganglia, dystrophic changes of increasing severity with immobilization time were found, including pericellular edema, vacuolized neuroplasm, pycnotic changes, cytolysis and destruction. Chromatophilic matter decreased and was partly bleached, and amitotic division occurred. A portion of the sciatic nerve fibers were argentophilic, and some fragmentary decomposition occurred. Considerable dystrophic changes occurred in the motor nerve endings. Author

N81-20696*# National Aeronautics and Space Administration, Washington, D. C.

EXPERIMENTAL JOINT IMMOBILIZATION IN GUINEA PIGS. EFFECTS ON THE KNEE JOINT

J. P. MarcondesdeSouza, F. F. Machado, A. Sesso, and V. Valeri Sep. 1980 32 p refs Transl. into ENGLISH from Rev. da Assoc. Med. Brasil (Brazil), v. 10, no. 7, 1964 p 159-175 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Faculty of Medicine of Ribeirao Preto (Brazil)
(Contract NASw-3199)
(NASA-TM-76067) Avail: NTIS HC A03/MF A01 CSCL 06C

In young and adult guinea pigs, the aftermath experimentally induced by the immobilization of the knee joint in hyperextended forced position was studied. Joint immobilization which varied from one to nine weeks was attained by plaster. Eighty knee joints were examined macro and microscopically. Findings included: (1) muscular hypotrophy and joint stiffness in all animals, directly proportional to the length of immobilization; (2) haemoarthrosis in the first week; (3) intra-articular fibrous tissue proliferation ending up with fibrous ankylosis; (4) hyaline articular cartilage erosions; (5) various degrees of destructive menisci changes. A tentative explanation of the fibrous tissue proliferation and of the cartilage changes is offered. S.F.

N81-20697*# National Aeronautics and Space Administration, Washington, D. C.

CHANGE IN ENERGY EXPENDITURE AND BRAIN AND ADRENAL CONTENT OF CATECHOLAMINES IN RATS DURING MUSCULAR LOADING AND HYPOKINESIA

V. D. Rozanova, T. G. Savkiv, and N. A. Khodorova May 1980 11 p refs Transl. into ENGLISH from Fiziol. Zh. (USSR), v. 62, no. 2, 1976 p 304-309 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Academy of Medical Sciences, Moscow
(Contract NASw-3198)
(NASA-TM-76148) Avail: NTIS HC A02/MF A01 CSCL 06C

In male 1-7 month old rats, the growth and the protein content of skeletal muscles were higher than in female rats while the O2 consumption and the heart rate were lower. This is combined with reduction of the thyroid gland weight and of catecholamine content in adrenals at the age of 7 months. The development of male and female rats (1-7 month) under conditions of systematic muscular loads increases the growth tempo and protein of skeletal muscles and intensifies the degree of reduction of energy expenditure and the heart rate. This is accomplished by the greater reduction of relative weight of the thyroid gland and, at the age of 7 months, by reduction of the noradrenaline content in the brainstem. Hypodynamic conditions have the exact opposite effect. Author

N81-20698*# National Aeronautics and Space Administration, Washington, D. C.

EFFECT OF SIX-MONTH HYPOKINESIA IN DOGS ON MINERAL COMPONENT, RECONSTRUCTION AND MECHANICAL PROPERTIES OF BONE TISSUE

A. I. Volozhin, M. P. Pavlova, I. Sh. Muradov, G. P. Stupakov, and V. A. Korzhenyants May 1980 10 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), no. 6, Nov. - Dec. 1976 p 34-38 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by N. A. Semashko Moscow Medical Stomatological Inst. (USSR)
(Contract NASw-3198)
(NASA-TM-76168) Avail: NTIS HC A02/MF A01 CSCL 06C

Ca45 incorporation into the bones of the limbs, particularly in the area of the muscle attachment increased in dogs as a result of 6 month hypokinesia. There were no phenomena of osteoporosis in the cortical layer of the diaphyses; however, changes in the form of osteons, an increase in the number of anastomoses between the channels and the thinning of the subperiosteal layer pointed to disturbances of the bone tissue reconstruction. Mineral saturation of the bone microstructures of the experimental dogs had a tendency to rise. No changes in the mechanical properties of the long bones occurred as a result of hypokinesia in dogs. Author

N81-20699*# National Aeronautics and Space Administration, Washington, D. C.

COMPARISON OF EARLY REACTIONS OF THE BLOOD SYSTEM IN RATS TO IMMOBILIZATION, THE ACTION OF HYPOXIA AND THE ADMINISTRATION OF ERYTHROPOIETIN

P. D. Gorizontov, M. I. Fedotova, V. I. Gudim, and O. I. Belousova May 1980 12 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), no. 3, May - Jun. 1977 p 41-49 Transl. by Scientific Translation Service, Santa Clara, Calif.
(Contract NASw-3198)
(NASA-TM-76169) Avail: NTIS HC A02/MF A01 CSCL 06C

Three series of experiments were simultaneously carried on rats with the purpose of studying the action of different stimulants on the blood system; rats were subjected to immobilization, hypoxic hypoxia and erythropoietin administration. Changes in various cellular forms in the bone marrow, the thymus and the spleen were studied. A unitypical reaction, as in stress, was noted during the first hours; a reduction of the cell count in the lymphoid organs, a reduction of granulocytes and an increase of lymphoid cells in the bone marrow. The differences were chiefly quantitative. This was followed by stimulation of myelo and erythropoiesis determined by the specific features of the action

applied. Nonspecific blood reaction was apparently due to activation of the adaptation mechanisms. Author

N81-20700*# National Aeronautics and Space Administration, Washington, D. C.
PRELIMINARY RESULTS OF SCIENTIFIC RESEARCH ON BIOSATELLITE KOSMOS-1129
Aug. 1980 35 p Transl. into ENGLISH of "Predvaritelnyye Rezultaty Nauchnykh Issled. na Biosputnike Kosmos-1129" (USSR), Moscow, Min. of Health USSR and the Inst. of Med. and Biol., Probl. and the Interkosmos Council of the Acad. of Sci. USSR, 1980 p 1-37 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76287) Avail: NTIS HC A03/MF A01 CSCL 06C

The first physiological study aimed at deeper examination mechanisms of weightlessness and adaptation/readaptation is described. It dealt with metabolism, support motor changes and nonspecific changes connected with stress reaction. Wistar rats were used in a triple setup: flight/vivarium/biosatellite mockup. Animal condition was assessed on motor activity and body temperature. Extensive tables show weight, blood and enzyme analysis, etc. Animals groups were labeled: stress, behavior, body composition, biorhythm, ontogenesis. The second or biological study dealt with tumorous carrot tissues but humidity control was defective: some indices are reported such as cell membrane permeability, tissue respiration, etc. It also was concerned with a fowl embryogenetic experiment (Japanese quail) but mechanical effects on landing reduced its success. The third study, on radiation dosimetry, presents a little tabulated data but chiefly gives lists of satellite detector units of different kinds and from different countries. Author

N81-20701*# National Aeronautics and Space Administration, Washington, D. C.
ACTIVITY OF CERTAIN ENZYMES IN SUBCELLULAR FRACTIONS OF RAT LIVER AFTER FLIGHT ON COSMOS 1129 BIOSATELLITE
R. A. Tigranyan and Ye. G. Vetrova Dec. 1980 16 p refs Transl. into ENGLISH of "Aktivnost Nekotorykh Fermentov v Subkletochnykh Fraktsiyakh Pecheni Krys. Posle Poleta Biosputnika Kosmos-1129" Moscow, 1980 p 1-20 Presented at the 11th Joint Soviet-Am. Working Group on Space Biol. and Med., Moscow, Oct. 1980 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Inst. of Medical and Biological Problems, Ministry of Health (USSR)
(Contract NASw-3198)
(NASA-TM-76472) Avail: NTIS HC A02/MF A01 CSCL 06C

Studies of the effect of extreme space flight factors on the conditions of oxidizing metabolism in rat liver are described. The animals were flown on the biosatellite Cosmos 936, and compared to a synchronous ground experiment. The material and methods utilized in the study are presented. T.M.

N81-20702# IIT Research Inst., Chicago, Ill.
DESIGN, CONSTRUCTION AND TESTING OF A dc BIOEFFECTS TEST ENCLOSURE FOR SMALL ANIMALS Final Report, 26 Sep. 1978 - Jun. 1980
M. J. Frazier and M. M. Preache Nov. 1980 274 p refs
(Contracts DE-FG01-78ET-10157; ET-78-C-01-3026)
(DOE/RA-10157/1) Avail: NTIS HC A12/MF A01

The engineering development of a dc bioeffects test enclosure for small laboratory animals is described as well as the biological protocol for the use of such enclosures in the testing of animals to determine possible biological effects of the environment associated with HVDC transmission lines. The test enclosure is a modular unit which can house up to eight rat sized animals in individual compartments. Multiple test enclosures can be used to test larger numbers of animals. A prototype test enclosure was fabricated and tested to characterize its electrical performance characteristics. The test enclosure provides a simulation of the dominant environment associated with HVDC transmission lines; namely, a static electric field and an ion current density. A biological experimental design was developed for assessing the effects of the dominant components of the HVDC transmission line environment. DOE

N81-20970*# National Aeronautics and Space Administration, Washington, D. C.
LIFE SCIENCES: NO PLACE IN THE SUN
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 274-282 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 06C

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N81-20703*# National Aeronautics and Space Administration. Pasadena Office, Calif.
MULTIFUNCTIONAL TRANSDUCER Patent
Cyril Feldstein (JPL), Gilbert W. Lewis (JPL), Virgil H. Culler (JPL), and Samuel Merrbaum, Inventors (to NASA) (JPL) Issued 10 Feb. 1981 13 p Filed 1 Jun. 1979 Supersedes N79-25737 (17 - 16, p 2176) Sponsored by NASA
(NASA-Case-NPO-14329-1; US-Patent-4,249,417;
US-Patent-Appl-SN-044432; US-Patent-Class-73-141A;
US-Patent-Class-128-642; US-Patent-Class-128-774) Avail: US Patent and Trademark Office CSCL 06B

Several parameters of a small region of a muscle tissue or other object, can be simultaneously measured using with minimal traumatizing or damage of the object, a trifunctional transducer which can determine the force applied by a muscle fiber, the displacement of the fiber, and the change in thickness of the fiber. The transducer has three legs with inner ends joined together and outer ends formed to piece the tissue and remain within it. Two of the legs are relatively stiff, to measure force applied by the tissue, and a third leg is relatively flexible to measure displacement of the tissue relative to one or both stiff legs, and with the three legs lying in a common plane so that the force and displacement measurements all relate to the same direction of muscle movements. A flexible loop is attached to one of the stiff legs to measure changes in muscle thickness, with the upper end of the loop fixed to the leg and the lower end of the loop bearing against the surface of the tissue and being free to slide on the leg.
Official Gazette of the U.S. Patent and Trademark Office

N81-20704* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY, SUPPLEMENT 216
Feb. 1981 50 p
(NASA-SP-7011(216)) Avail: NTIS HC $7.00 CSCL 06E

One hundred twenty reports, articles, and other documents introduced into the NASA scientific and technical information system in January 1981 are listed. Topics include: sanitary problems; pharmacology; toxicology; safety and survival; life support systems; exobiology; and personnel factors. S.F.

N81-20705 Duke Univ., Durham, N. C.
THE VISCOELASTIC BEHAVIOR OF THE HUMAN INTERVERTEBRAL DISC Ph.D. Thesis
Robert Allen Casper 1980 150 p
Avail: Univ. Microfilms Order No. 8105654

Intervertebral motion units were tested with posterior elements intact, removed (modified) just prior to testing, and after re-equilibration following posterior element removal. In both static and dynamic tests no significant difference was observed between intact and modified specimens if sufficient recovery time was allowed between testing. Marked changes were observed, however, for specimens which had been allowed to re-equilibrate following posterior element removal. For static tests, disc stiffness increased in both creep and relaxation tests. Creep rate and relaxation rate, on the other hand, appeared unaltered as a result of transection and re-equilibration. For dynamic tests initial stiffness increased substantially, but little difference was observed at higher deformation. Dissert. Abstr.

N81-20706 Northwestern Univ., Evanston, Ill.
HYPOXIA IN THE WALLS OF LARGE BLOOD VESSELS Ph.D. Thesis

Donald Gene Buerk 1980 273 p
Avail: Univ. Microfilms Order No. 8104696

Detailed oxygen partial pressure (PO2) profiles were measured in normal respiring arterial tissue using Whalen-type (recessed cathode) oxygen electrodes under experimental conditions in vivo and in vitro. The outer blood vessel wall surface PO2 was also measured in vivo. The methods for fabricating the standard Whalen-type and mechanically strengthened glass micropipette electrodes with cathode diameters less than 5 microns are described. Measurements for the largest blood vessels were obtained with a Whalen-type oxygen macroelectrode (cathode diameter 5-10 microns) housed in a 31 gauge (200 microns) hypodermic needle. The recessed cathode design was examined mathematically to predict the characteristics of electrodes with deep and shallow recesses. Dissert. Abstr.

N81-20707*# Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. Dept. of Physiology.
SPECIALIZED PHYSIOLOGICAL STUDIES IN SUPPORT OF MANNED SPACE FLIGHT Final Report
U. C. Luft Jul. 1980 110 p refs
(Contract NAS9-15483)
(NASA-CR-160936) Avail: NTIS HC A06/MF A01 CSCL 06P

The reversible changes that take place in the cardiovascular system during weightlessness were investigated. Particular attention was given to the assessment of cardiovascular functions during and after space missions. One of the most important of these functions is the amount of blood pumped by the heart per min at rest and during exercise of gravitational stress. For individual titles, see N81-20708 through N81-20712.

N81-20708*# Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.
TOLERANCE OF LOWER BODY NEGATIVE PRESSURE (LBNP) IN ENDURANCE RUNNERS, WEIGHTLIFTERS, SWIMMERS AND NONATHLETES Final Report
In its Spec. Physiol. Studies in Support of Manned Space Flight Jul. 1980 p 1-35 refs (For primary document see N81-20707 11-52)
Avail: NTIS HC A06/MF A01 CSCL 06P

Thirteen endurance runners (R), 12 weightlifters (WL), 12 swimmers (SW) and 10 nonathletes (NA) were tested for their tolerance of lower body negative pressure (LBNP) in consecutive 5 minute stages at -20, -30, -40, -50 and -60 torr. Each subject also performed an exercise test on a bicycle ergometer with progressive workloads to exhaustion to determined aerobic capacity. The R had a much higher aerobic capacity than any of the other groups, but a significantly lower LBNP tolerance. While responses in heart rate and pulse pressure were quite similar in all 4 groups, the rate of increase in leg volume relative to LBNP stress (leg compliance, LC) was considerably greater in R than in the other athletes and NA. The greater LC in R could be attributed not only to a more rapid shift of blood to the lower extremities but also to a greater tendency for edema formation, both contributing to a more rapid loss in effective central blood volume for a given LBNP stress. These results substantiate earlier observations which led to the conclusion that endurance running is not advisable as a training regimen for astronauts. R.C.T.

N81-20709*# Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.
NONINVASIVE AORTIC BLOODFLOW BY PULSED DOPPLER ECHOCARDIOGRAPHY (PDE) COMPARED TO CARDIAC OUTPUT BY THE DIRECT FICK PROCEDURE Final Report
In its Spec. Physiol. Studies in Support of Manned Space Flight Jul. 1980 p 36-48 refs (For primary document see N81-20707 11-52)
Avail: NTIS HC A06/MF A01 CSCL 06B

Left ventricular stroke volume was estimated from the systolic velocity integral in the ascending aorta by pulsed Doppler Echocardiography (PDE) and the cross sectional area of the aorta estimated by M mode echocardiography on 15 patients with coronary disease undergoing right catheterization for diagnostic purposes. Cardiac output was calculated from stroke volume and heart volume using the PDE method as well as the Fick procedure for comparison. The mean value for the cardiac output via the PDE method (4.42 L/min) was only 6% lower than for the cardiac output obtained from the Fick procedure (4.69 L/min) and the correlation between the two methods was excellent ($r=0.967$, p less than .01). The good agreement between the two methods demonstrates that the PDE technique offers a reliable noninvasive alternative for estimating cardiac output, requiring no active cooperation by the subject. It was concluded that the Doppler method is superior to the Fick method in that it provides beat by beat information on cardiac performance. R.C.T.

N81-20710*# Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.
BEAT BY BEAT STROKE VOLUME ASSESSMENT BY PDE IN UPRIGHT AND SUPINE EXERCISE Final Report
In its Spec. Physiol. Studies in Support of Manned Space Flight Jul. 1980 p 50-79 refs (For primary document see N81-20707 11-52)
Avail: NTIS HC A06/MF A01 CSCL 06P

A 3.0 MHz pulse Doppler echocardiograph was used to estimate instantaneous stroke volume and cardiac output in 8 men during steady state supine and upright exercise at 300 kpm/min which were compared with other studies utilizing invasive procedures. The mean transients in heart rate and stroke volume and cardiac output for the first 20 sec of exercise in each posture were then determined. Centerline blood velocities were obtained in the ascending aorta with the transducer positioned manually in the suprasternal notch. Mean supine values for stroke volume and cardiac output at rest and exercise were 111 (6.4) and 112 ml (9.7 L/min), respectively, for supine. The corresponding results for upright were 76 (5.6) and 92 ml (8.4 L/min). These values compare favorably with prior studies. The transient response of cardiac output following the onset of upright was about twice as fast as in S because of the rapid and almost immediate upsurge in stroke volume. In supine, only heart rate served to augment cardiac output as stroke volume initially fell. The faster initial aortic flow in upright must represent the rapid mobilization of pooled venous blood from the leg veins which more than accounts for the additional volume (184 ml) of blood passing through the aorta during upright compared with supine in the first 20 sec. R.C.T.

N81-20711*# Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.
INSTANTANEOUS STROKE VOLUME BY PDE DURING AND AFTER CONSTANT LBNP (-50 TORR) Final Report
In its Spec. Physiol. Studies in Support of Manned Space Flight Jul. 1980 p 80-91 refs (For primary document see N81-20707 11-52)
Avail: NTIS HC A06/MF A01 CSCL 06S

Six male subjects were exposed to -50 torr lower body negative pressure (LBNP) for 10 min while stroke volume was recorded beat by beat at regular intervals before, during and after release of LBNP. Stroke volume was calculated from the systolic velocity integral in the ascending aorta by pulsed Doppler echocardiography (PDE) and the cross sectional area of the vessel by M mode echocardiography. Changes in leg volume were recorded continuously and blood pressure was taken every minute. Stroke volume dropped by 51% of the control in the first 33 sec of LBNP and continued to decline slowly to -62% toward the end. Heart rate increased by 15% in the first 10 sec and was 22% above control at the end of exposure. The resulting cardiac output closely followed the course of stroke volume (-47% at 33 sec, -53% at 8 min) showing that the modest increase in heart rate did little to offset the drop in stroke volume. Leg volume increased markedly within the first 10 sec with a more gradual rise reaching +3.5% at the end. Upon sudden release of LBNP, leg volume dropped significantly during the first 3 sec simultaneously with an increase in stroke volume followed by a substantial decline in heart rate below the baseline. R.C.T.

N81-20712*# Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.
CHANGES IN CARDIAC OUTPUT AND TIBIAL ARTERY FLOW DURING AND AFTER PROGRESSIVE LBNP Final Report
In its Spec. Physiol. Studies in Support of Manned Space Flight Jul. 1980 p 92-104 refs (For primary document see N81-20707 11-52)

Avail: NTIS HC A06/MF A01 CSCL 06S

A 3.0 MHz Pulsed Doppler velocity meter (PD) was used to determine blood velocities in the ascending aorta from the suprasternal notch before, during and after progressive 5 min stages of lower body negative pressure (LBNP) in 7 subjects. Changes in stroke volume were calculated from the systolic velocity integrals. A unique 20 MHz PD was used to estimate bloodflow in the posterior tibial artery. With -20 torr mean stroke volume fell 11% and then continued to decline by 48% before LBNP was terminated. Mean tibial flow fell progressively with LBNP stress, due to an increase in reverse flow component and a reduction in peak forward flow and diameter. Stroke volume increased and heart rate fell dramatically during the first 15 sec of recovery. The LBNP was terminated early in 2 subjects because of vasovagal symptons (V). During V the stroke volume rose 86% which more than compensated for the drop in heart rate. This implies that V is accompanied by a paradoxical increase in venous return and that the reduction in HR is the primary cardiovascular event. During the first 15 sec of recovery these 2 subjects had a distinctive marked rise to heart rate reminiscent of the Bainbridge reflex. R.C.T.

N81-20713*# National Aeronautics and Space Administration, Washington, D. C.

IMPORTANCE OF PHOTOELECTRONYSTAGMOGRAPHY FOR CLINICAL STUDY OF THE VESTIBULAR FUNCTION

S. N. Khechinashvili, B. M. Zargaryan, and K. G. Karakozov Sep. 1980 10 p refs Transl. into ENGLISH from Zh. Ushnykh Nosovykh Gorlovykh Bolez. (USSR), no. 2, May - Jun. 1978 p 68-72 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Tbilissi S. M. Kirov State Inst. for Advanced Training for Advanced Physicians, (USSR)

(Contract NASw-3198)

(NASA-TM-76404) Avail: NTIS HC A02/MF A01 CSCL 06P

A photoelectric nystagmograph containing a flexible doubled glass fiber light guide was designed and tested. During electric stimulation of the vestibular analyzer a graphic recording of galvanic nystagmus was obtained. The use of flexible glass fiber guides for the connection of the patient with a light source and photoreceiver solves some methodical problems and allows the usage of powerful lighting and high fidelity photomultiplier. The usage of DC amplifiers while signal processing assures the elimination of the most important factors leading to errors in the evaluation of information during nystagmographic investigations. T.M.

N81-20714*# National Aeronautics and Space Administration, Washington, D. C.

PROGRAM FOR THE MEDICAL EXAMINATION (CONSULTATION) OF COSMONAUTS

Dec. 1980 28 p refs Transl. into ENGLISH of "Programma Meditsinskogo Obsledovaniya (Ekspertizy) Kosmonavtov" Moscow, Aug. 1980 p 1-24 Presented at 11th Joint Soviet-Am. Working Group on Space Biol. and Med., Moscow, Aug. 1980 p 1-24 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original document prep. by Inst. of Medical and Biological Problems, Ministry of Health, USSR

(Contract NASw-3198)

(NASA-TM-76471) Avail: NTIS HC A03/MF A01 CSCL 06E

The medical selection process used to screen cosmonaut candidates is outlined. The various stages of selection are discussed, and the specific types of medical examinations are described. Various criteria used for selection are presented. T.M.

N81-20715*# National Aeronautics and Space Administration, Washington, D. C.

SURGICAL ACCESS TO SEPARATE BRANCHES OF THE CAT VESTIBULAR NERVE

L. A. Radkevich and G. S. Ayzikov Jan. 1981 8 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (USSR), v. 63, no. 12, 1977 p 1748-1751 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by the Scientific Research Inst. of Biological Testing of Chemical Compounds, Moscow

(Contract NASw-3198)

(NASA-TM-76478) Avail: NTIS HC A02/MF A01 CSCL 06C

A posteroventral approach for access to separate branches of the cat vestibular nerve is presented which permits simultaneous surgical access to the ampullary and otolithic nerves. Surgical procedures are discussed. A.R.H.

N81-20716*# National Aeronautics and Space Administration, Washington, D. C.

FUNCTIONAL-MORPHOLOGICAL PARALLELS OF THE HYPOTHALAMO-PITUITARY-ADRENAL SYSTEM RESPONSE REACTION TO LONG-TERM HYPOKINESIA

Ye. P. Tsvetov, S. I. Razin, and A. V. Rychko Apr. 1980 10 p refs Transl. into ENGLISH from Vrach. Delos (USSR), no. 9, 1975 p 9-14 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Vinnitsa Medical Inst. (USSR)

(Contract NASw-3199)

(NASA-TM-76001) Avail: NTIS HC A02/MF A01 CSCL 06S

The effect of 2 and 4 week hypokinesia regimens on the hypothalamo-pituitary-adrenal system (HPAS) was investigated in 110 inbred mice. Progressive exhaustion and pathological reorganization of the HPAS morphofunctional structures was revealed. On the basis of established facts of interlineary and interspecies differences in the HPAS response, it is suggested that the animal body response reaction to the long term effects of hypokinesia depends largely on its HPAS resistance and the values of this system's defensive adaptation potential. S.F.

N81-20717*# National Aeronautics and Space Administration, Washington, D. C.

ROLE OF A DECREASE IN BODY HEAT CONTENT IN THE THERMOREGULATORY REACTION OF THE CONCHA AURICULAE VESSELS

N. A. Slepchuk and G. V. Rumyantsev Sep. 1980 14 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (USSR), v. 64, no. 6, 1978 p 843-849 Original language document announced as A78-34787 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Academy of Sciences (USSR)

(Contract NASw-3198)

(NASA-TM-76370) Avail: NTIS HC A02/MF A01 CSCL 06P

At the constant ambient temperature 28-30 C the rabbit ear vessels were dilated and their temperature was 34.8/0.1 C. Administration of the 23-29 C water into the stomach entailed thermoregulatory construction of the ear vessels within 15-25 min. The response occurred at various combinations of temperature changes in different parts of the body. The heat content of the rabbit body, as calculated by the blood temperature in the aorta arc, reduced by 266.3 + or - 26.2 cal/kg at the beginning of the response. The decrease in the organism heat content seems to serve as a signal for occurrence of a corresponding thermoregulatory response. Author

N81-20718*# National Aeronautics and Space Administration, Washington, D. C.

CHARACTERISTICS OF VESTIBULOSENSORY REACTIONS STUDIED BY EXPERIMENTAL CALORIC TEST

V. Z. Kapranov Sep. 1980 6 p refs Transl. into ENGLISH from Vest. Otorinolaringol. (USSR), no. 1, Jan. - Feb. 1979 p 48-49 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(NASA-TM-76386) Avail: NTIS HC A02/MF A01 CSCL 06P

Vestibulo-sensory reactions were studied in 135 workers who were in contact with nitroethers, by the method of an experimental caloric test. The response vestibulo-sensory reactions were recorded by means of an electroencephalograph. The changes in the sensory reaction depended on the duration of the workers' contact with toxic agents. A study of illusion reactions by the labyrinth calorization widens diagnostic possibilities in the examination of functional condition of the vestibular analyser considerably. T.M.

N81-20719*# National Aeronautics and Space Administration, Washington, D. C.

MENIERE'S DISEASE: A SURGEON'S TACTICS

I. Soldatov Sep. 1980 7 p Transl. into ENGLISH from Med. Gazeta (USSR), 20 Jun. 1979 p 3 Transl. by Scientific Translation

Service, Santa Barabara, Calif.
(Contract NASw-3198)
(NASA-TM-76398) Avail: NTIS HC A02/MF A01 CSCL 06E

Surgical procedures for treating Meniere's disease are discussed. Based on the results of 250 operations, it is concluded that interventions are sufficiently effective not only with vestibular dysfunction, but also with hearing disorders. In surgical treatment of Meniere's disease, it is expedient to adhere to by-stage tactics: to start with the simplest and least traumatic interventions - operations on the nerves of the tympanic cavity, and if these are ineffective to use more complex methods, including drainage or shunting of the endolymphatic sac. S.F.

N81-20720*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF INACTION ON FUNCTION OF FAST AND SLOW MUSCLE SPINDLES
R. S. Arutyunyan Sep. 1980 11 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR im. I.M. Sechenova (USSR), v. 65, no. 12, Dec. 1979 p 1833-1837 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by I.M. Sechenov Inst. of Evolutionary Physiology and Biochemistry, Academy of Sciences, Leningrad
(Contract NASw-3198)
(NASA-TM-76374) Avail: NTIS HC A02/MF A01 CSCL 06P

There is no data on the comparative effect of tenotomy on the function of the muscle spindles of fast and slow muscles. This study covers this question. The experiments were conducted on cats. The musculus extensor digitorum longus (m. EDL) was selected as the fast muscle, and the musculus soleus (m. Sol.) as the slow. In a comparison of the spontaneous activity of primary and secondary endings of the fast and slow muscle spindles (i.e., the activity with complete relaxation of the muscles) normally no difference between them was successfully found. The authors recorded the integrative, and not the individual activity, and secondly, under conditions of such recording technique, those slight changes that are observed in the fast muscle receptors could remain unnoticed. Author

N81-20721*# National Aeronautics and Space Administration, Washington, D. C.
OBJECTIVE APPRAISAL OF TOLERANCE TO VENTRICULOGRAPHY WITH VARIOUS RADIOCONTRAST MEDIA (ACCORDING TO ELECTRONYSTAGMOGRAPHY DATA)
N. S. Blagoveshchenskaya and V. L. Puchkov Sep. 1980 13 p refs Transl. into ENGLISH from Vop. Neirokhir. (USSR), no. 2, Mar.-Apr. 1980 p 47-52 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Inst. of Neurosurgery, Academy of Medical Sciences, Moscow
(Contract NASw-3199)
(NASA-TM-76340) Avail: NTIS HC A02/MF A01 CSCL 06E

The vestibulo oculomotor reflex (nystagmus) was recorded by means of electronystagmography in 33 neurosurgical patients in dynamics prior to and after ventriculography. For contrasting the ventricular system a water soluble medium (Conrey, dimer X or Amipak) was used in 18 patients and contrast mixtures of water soluble agents in combination with Myodil emulsion in 15. It was established that after ventriculography with water soluble media the trunk vestibular reactions in all types of nystagmus grew frequently and sharply and the vestibulovegetative reactions increased markedly. Author

N81-20722*# Louisiana State Univ., Shreveport. Dept. of Orthopaedics.
DEVELOPMENT OF A NEW NONINVASIVE METHOD TO DETERMINE THE INTEGRITY OF BONE IN VIVO Final Technical Report
Subrata Saha 10 Nov. 1980 7 p refs
(Contract NAS9-15950)
(NASA-CR-160922) Avail: NTIS HC A02/MF A01 CSCL 06P

An electromagnetic sensor for monitoring elastic waves in bone was developed. It does not require the use of traction pins and the output is not affected by soft tissue properties, a difficulty commonly encountered when using ultrasonic and vibration methods to determine in vivo properties of bone. T.M.

N81-20723*# National Aeronautics and Space Administration, Washington, D. C.
PATHOGENESIS OF SUDDEN DEATH FOLLOWING WATER IMMERSION (IMMERSION SYNDROME)
M. Buhring and H. F. Spies Mar. 1981 12 p refs Transl. into ENGLISH from Z. fuer Rechtsmedezin (West Germany), v. 83, 1979 p 121-127 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Johann-Wolfgang-Goethe Univ., Frankfurt
(NASA-TM-76542) Avail: NTIS HC A02/MF A01 CSCL 06S

Sympathetic activity under cold stress is investigated. Predominantly vagal cardio-depressive reflexes are discussed besides currently known mechanisms of sudden death after water immersion. Pronounced circulatory centralization in diving animals as well as following exposure in cold water indicates additional sympathetic activity. In cold water baths of 15 C, measurements indicate an increase in plasma catecholamine levels by more than 300 percent. This may lead to cardiac arrhythmias by the following mechanisms: cold water essentially induces sinus bradycardia; brady-and tachycardiarrhythmias may supervene as secondary complications; sinusbradycardia may be enhanced by sympathetic hypertonus. Furthermore, ectopic dysrhythmias are liable to be induced by the strictly sympathetic innervation of the ventricle. Myocardial ischemia following a rise in peripheral blood pressure constitutes another arrhythmogenic factor. Some of these reactions are enhanced by alcohol intoxication. M.G.

N81-20724*# National Aeronautics and Space Administration, Washington, D. C.
STUDY ON CONTRACTION AND RELAXATION OF EXPERIMENTALLY DENERVATED AND IMMOBILIZED MUSCLES: COMPARISON WITH DYSTROPHIC MUSCLES
M. Takamori, Mitsuhiro Tsujihata, Masataka Mori, Ryuji Hazama, and Yoshihiko Ide Feb. 1980 28 p refs Transl. into ENGLISH from Nippon Naika Gakkai Zasshi (Japan), v. 67, no. 3, 1978 p 25-35 Presented at the 5th Intern. Conf. of the Muscular Dystrophy Assoc., Durango, Colo., Jun. 1976, and at the 18th Conf. of the Japan. Acad. of Neurol., Nagoya, May 1977 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Nagaskai Univ. School of Medicine, Japan
(NASA-TM-76053) Avail: NTIS HC A28/MF A01 CSCL 06P

The contraction-relaxation mechanism of experimentally denervated and immobilized muscles of the rabbit is examined. Results are compared with those of human dystrophic muscles, in order to elucidate the role and extent of the neurotrophic factor, and the role played by the intrinsic activity of muscle in connection with pathogenesis and pathophysiology of this disease. M.G.

N81-20725*# National Aeronautics and Space Administration, Washington, D. C.
THE FUNCTIONAL STATUS OF THE HUMAN VESTIBULAR ANALYSOR FOLLOWING 56 DAYS IN AN AQUEOUS IMMERSION MEDIUM
E. I. Matsnev and Ye. B. Shulzhenko Feb. 1981 14 p refs Transl. into ENGLISH from Vestn. Otornolaringol. (USSR), no. 2, 1976 p 18-24 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75888) Avail: NTIS HC A02/MF A01 CSCL 06P

Two male volunteers were kept hypokinetic in the immersion and physiological parameters were evaluated following the experiment. Prophylactic measures (g-forces, physical exercises, and supplementary salt and water) were applied daily. Caloric and equilibrium tests were utilized to evaluate the physiological responses. The functional changes observed after the 56 day immersion were found to be of a moderate type which normalized quite quickly. T.M.

N81-20726*# National Aeronautics and Space Administration, Washington, D. C.

ACTIVITY OF THE RIGHT CARDIAC VENTRICLE AND METABOLISM IN HEALTHY PERSONS DURING AN ORTHOSTATIC TEST AFTER SHORT TERM IMMOBILIZATION

V. V. Chestukhin, V. Ye. Katkov, A. A. Seid-Gusaynov, B. I. Shalnev, V. S. Georgiyevskiy, O. Kh. Zybin, V. M. Mikhaylov, and V. N. Utkin Feb. 1981 10 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), no. 2, 1979 p 36-40 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Ministry of Public Health of the USSR, Moscow
(Contract NASw-3199)
(NASA-TM-76519) Avail: NTIS HC A02/MF A01 CSCL 06P

A 15 minute orthostatic test was performed on healthy male volunteers under conditions of catheterization of the right ventricle of the heart and the radial (or brachial) artery before and after 5 day bedrest in an antiorthostatic position of the body (with the foot of the bed raised 4.5 degrees). The change to a vertical position after immobilization was attended by a more marked increase in the rate of cardiac contractions, an increase of max dp/dt pressure in the right ventricle, and a decrease of cardiac and stroke indices. The decrease of the cardiac index was compensated for, to a certain measure, by a further increase in the extraction and utilization of O2 by the tissues. The arterial blood pH did not change essentially, while the decrease in pCO2 and content of standard bicarbonate was more marked.
Author

N81-20727*# National Aeronautics and Space Administration, Washington, D. C.

THE ENZYME SPECTRUM OF THE SMALL INTESTINE WITH HYPODYNAMIA UNDER CONDITIONS OF HIGH TEMPERATURE

A. Abdusattarov May 1980 6 p refs Transl. into ENGLISH from Uzb. Biol. Zh. (USSR), no. 4, Jul. - Aug. 1978 p 80-81 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76150) Avail: NTIS HC A02/MF A01 CSCL 06P

The influence of hypodynamia on the functioning of various body organs and systems is discussed. The methodology used and the results obtained are detailed. S.F.

N81-20728*# National Aeronautics and Space Administration, Washington, D. C.

ORTHOSTATIC HYPOTENSION

J. Ninet Feb. 1981 11 p refs Transl. into ENGLISH from Lyon Medical (France), v. 244, no. 13, 1980 p 7-9 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Hopital Edouard-Herriot, Clinique Medicale A, France
(Contract NASw-3199)
(NASA-TM-75889) Avail: NTIS HC A02/MF A01 CSCL 06S

Basic orientation of the article, by the leader of a group of medical researchers associated with hospitals in Lyon, France, is toward definition and classification. A table divides OH (orthostatic hypotension) according to physiopathological classification into sympathicotonic and asympathicotonic types and then each of these into primary and secondary with subdivisions. The figure sketches organization and functioning of the baroreflex arc. Applications to clinical study of circulatory reflexes, listing measurement tests and the biological study of hormonal regulation listing the appropriate kinds of studies. Data are not given.
Author

N81-20729# School of Aerospace Medicine, Brooks AFB, Tex.

NUCLEAR SURVIVABILITY/VULNERABILITY OF AIRCREWS: AN EXPERIMENTAL APPROACH Final Report, Jan. 1977 - Sep. 1980

Rayford P. Patrick, Alton J. Rahe, Neal E. Lof, Kenneth A. Hardy, and Robert E. Cordts Jan. 1981 38 p refs
(AF Proj. 7757)
(AD-A095501; SAM-TR-81-1) Avail: NTIS HC A03/MF A01 CSCL 15/6

The complexity of modern manned-weapons systems requires maximal operator proficiency to insure mission success. This experiment was designed to determine, using trained subhuman primates, the effects of ionizing radiation upon tracking and discrete-avoidance behavior. During exposure to cobalt 60 gamma radiation given in divided doses over 7 1/2 hours, the monkeys performed Multiple Alternative Reaction Time (MART) tasks and on the Primate Equilibrium Platform (PEP). Testing at two radiation levels is reported: a high-dose total of 1,440 rad (14.4 Gy) and a low-dose total of 360 rad (3.6 Gy). Testing and observation were done for a total of 10 hours on the day of irradiation for both radiation levels and on the day following irradiation for the high-dose level only. GRA

N81-20730# Desmatics, Inc., State College, Pa.

COMPUTATIONAL ASPECTS OF INCORPORATING AUXILIARY INFORMATION INTO AN IMPACT ACCELERATION INJURY PREDICTION MODEL

John J. Peterson and Dennis E. Smith Feb. 1981 21 p refs
(Contract N00014-79-C-0128; NR Proj. 267-037)
(AD-A095299; TR-112-7) Avail: NTIS HC A02/MF A01 CSCL 12/1

Auxiliary information may sometimes be used in development of a mathematical model in order to improve the estimated values of unknown parameters. This report discusses computational procedures which allow the application of commonly used nonlinear estimation programs to incorporate various sources of auxiliary information into an impact acceleration injury prediction model. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N81-20808# Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).

TEAMWORK IN TARGET ACQUISITION

D. Dey, N. Ninz, and H. Mutschler (Fraunhofer-Inst. fuer Informations- und Datenverarbeitung, Karlsruhe) *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 16 p refs (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N81-20731*# Hamilton Standard, Windsor Locks, Conn.

LIGHTSIDE ATMOSPHERIC REVITALIZATION SYSTEM Final Study Report, 1 Apr. - 30 Sep. 1980

Arthur K. Colling, Ross J. Cushman, Mark M. Hultman, and John R. Nason Oct. 1980 166 p refs
(Contract NAS9-13624)
(NASA-CR-160897; SVHSER-7224) Avail: NTIS HC A08/MF A01 CSCL 06K

The system was studied as a replacement to the present baseline LiOH system for extended duration shuttle missions. The system consists of three subsystems: a solid amine water desorbed regenerable carbon dioxide removal system, a water vapor electrolysis oxygen generating system, and a Sabatier reactor carbon dioxide reduction system. The system is designed for use on a solar powered shuttle vehicle. The majority of the system's power requirements are utilized on the Sun side of each orbit, when solar power is available. T.M.

N81-20732# Los Alamos Scientific Lab., N. Mex.

PERMEATION OF PROTECTIVE GARMENT MATERIAL BY LIQUID HALOGENATED ETHANES AND A POLYCHLORINATED BIPHENYL

R. W. Weeks, Jr. and M. J. McLeod Oct. 1980 46 p refs
(Contract W-7405-eng-36)
(LA-8572-MS) Avail: NTIS HC A03/MF A01

The halogenated ethanes 1,2-dichloroethane; 1,1,1-trichlorethane and 1,1,2-trichlorethane are used as chemical intermediates and in metal working operations; and polychlorinated biphenyls (PCBs) were used in the past by the tens of millions of pounds in various roles in American industry. Because of the widespread use and hazardous or potentially carcinogenic nature of these compounds, the degree of protection which was afforded against these compounds by certain protective garment materials was studied. Materials evaluated included: butyl rubber; milled nitrile rubber; neoprene rubber latex; nitrile rubber latex; polyethylene; poly(vinyl alcohol); surgical rubber latex; Teflon; and Viton as well as the following composite or multilayered materials: butyl-coated nylon; polyethylen-coated Tyvek; polyurethane-coated nylon; and poly(vinyl chloride)-coated nylon. The breakthrough time at which each liquid phase compound permeated these materials was studied by the time lag method. DOE

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

N81-20733*# Hardin-Simmons Univ., Abilene, Tex. Science Research Center.
RESPONSE OF SELECTED MICROORGANISMS TO EXPERIMENTAL PLANETARY ENVIRONMENTS Final Report, 30 Jun. 1979 - 31 Dec. 1980
Terry L. Foster Feb. 1981 49 p refs
(Grant NGR-44-095-001)
(NASA-CR-164064; FR-11) Avail: NTIS HC A03/MF A01 CSCL 06C

Anaerobic and aerobic sporeformers and non-sporeformers were cultivated anaerobically in nutrient media under various pressures (up to 1800 psi) of pure H2, CH4, NH3, and H2S. Viability assays were performed periodically to determine growth, survival, or spore survival. Hydrogen up to 1800 psi demonstrated little or no suppression of growth with the possible exception of Bacillus coagulans at 1800 psi. The obligate anaerobes grew very well. Under CH4 the obligate anaerobes again exhibited the most prolific growth, whereas the facultative anaerobes grew well except under higher pressures. Ammonia at low pressure was extremely toxic to all test organisms. At 100 psi all populations were killed within 24 hours except Staphylococcus aureus which survived for 72 hours and the Bacillus spp. which produced a surviving population of approximately 10,000 spores/ml. All populations in H2S were killed within 24 to 48 hours except Proteus mirabilis which decreased to 100 cells/ml and the Bacillus spp. Spore survival studies of two months duration demonstrated that B. coagulans and B. pumilus survived under all experimental conditions. Clostridium novyi type B and C. sporogenes were killed rapidly in NH3 and H2S and demonstrated no sporulation. Author

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N81-20734# California Univ., Los Angeles.
PERFORMANCE ANALYSIS OF DISTRIBUTED DATABASE SYSTEMS Ph.D. Thesis
Joao Eduardo deRezende Dantas 1980 159 p
Avail: Univ. Microfilms Order No. 8103989

A modification of the majority consensus algorithm is suggested and a comparison is made between the modified and the original algorithms through simulation. This comparison shows that improvement in performance is obtained with the modified scheme. An analytical model is then developed in order to predict performance of the systems using the modified protocol. The theory of network of queues is the basis for the development of the model. Although the network of queues that models the system does not have the product form solution, results that are true for those kind of networks are used as approximations in the model. Comparison with simulations are used to validate the model, and to refine the approximations. Dissert. Abstr.

N81-20735 Florida Univ., Gainesville.
CONTROL OF DATABASE ACCESS AND INTEGRITY IN CELLULAR-LOGIC DEVICES Ph.D. Thesis
Yang-Chang Hong 1980 137 p
Avail: Univ. Microfilms Order No. 8105583

A set of mechanisms for offloading database access and integrity control functions from a main frame computer (MFC) to a cellular logic (CL) device (to which the MFC is a front end computer) is described. These mechanisms mainly benefit from the associative techniques such as content and context searches, tagging and marking data, etc. They: (1) allow the data which are not authorized for access to be made invisible to the user's query; (2) allow two copies, original and modified, to be retained during database operation for various integrity control purposes; (3) allow the constraints, database access and integrity, to be activated or triggered for masking the unauthorized data, validating the database operations, or updating other related files; and (4) allow the data dependent constraints to be implemented as efficiently as the queries. It is demonstrated that the same associative techniques which make a CL device attractive for basic database functions can also be used for database access and integrity control functions. Dissert. Abstr.

N81-20736 Northwestern Univ., Evanston, Ill.
A FORMAL METHODOLOGY USING ATTRIBUTED GRAMMAR FOR MULTIPROCESSING SYSTEM DESIGN Ph.D. Thesis
Priscilla Marilyn Lu 1980 186 p
Avail: Univ. Microfilms Order No. 8104737

The concepts, techniques and algorithms used in SAGE (Specifications using Attributed Gammar for system Evaluation), a methodology that supports the design and development of multiple process software systems, are presented. The methodology extends the formal methods used in the definition of programming languages, and compiler techniques for characterizing the system's software specification and analyzing the implementation. In generating the formal model from the system's specification, system analysis is performed to ensure consistency and completeness and to detect ambiguities and cyclic dependencies in the grammar. This same model is used for test case generation. By transversing the parse tree formed from the productions of the grammar, the test case generator can enumerate sequences of test paths through the system. These test paths are used as a guide to the testers for formulating tests to drive the system for dynamic analysis. The system's grammar is used to build a deterministic pushdown automation which is the recognizer for validating the implemented system's execution. The attributed grammar in SAGE is augmented with the additional capability to express interprocess communication and synchronization. Dissert. Abstr.

N81-20737# Mitre Corp., Bedford, Mass.
LOGICAL CHANNEL THEORY Final Technical Report
Jonathan K. Millen Nov. 1980 39 p refs
(Contract F19628-80-C-0001; AF Proj. 2526)
(AD-A095663; MTR-3833; RADC-TR-80-259) Avail: NTIS HC A03/MF A01 CSCL 09/2

The theory of prime constraints and its application to security analysis is reviewed, and some examples are given. Different examples illustrate different advantages of the prime constraint

approach over previous methods: the ability to recognize the safety of a case of downgrading; the ability to handle nondeterministically specified systems; and the ability to avoid assigning security levels to hidden variables. Prime constraint graphs and related tools developed in FY79 were used for the computations in examples. GRA

N81-20738# Harvard Univ., Cambridge, Mass. Aiken Computation Lab.
ON PROBABILISTIC AND SYMMETRIC PARALLEL COMPUTATIONS
John H. Reif 1980 15 p refs
(Contract N00014-80-C-0647; Grant NSF MCS-79-21024)
(AD-A095657; TR-22-80) Avail: NTIS HC A02/MF A01 CSCL 09/2

There are many known examples of problems for which there is a probabilistic (sequential) algorithm more efficient than any known deterministic algorithm. This paper considers the question: Are parallel machines made more efficient by allowing processors to take probabilistic choices? We also consider the questions: What is the computational power of parallel machines, if we require transitions of processors to be symmetric? This is motivated by physical constraints to parallel computation such as energy consumption. Also, there appears to be some fundamental relationship between symmetrical and probabilistic computations. To partially answer these questions, we use previous studies of the computational complexity of parallel machines, studies of probabilistic computations, work on symmetric computations, and work relating probabilistic and symmetric computations. We formulate a general thesis for how both the probabilistic and symmetric types of parallel computation relate to other types of computation. GRA

N81-20739# Lerner Technology, Inc., Williamsville, N. Y.
AUTOMATED INTELLIGIBILITY MEASUREMENT SYSTEM Final Technical Report, 14 Dec. 1979 - 13 Aug. 1980
Theodore Lerner Griffiss AFB, N.Y. RADC Nov. 1980 43 p refs
(Contract F30602-80-C-0065)
(AD-A095664; RADC-TR-80-353) Avail: NTIS HC A03/MF A01 CSCL 05/8

The report discusses the design, development, and test of a microprocessor based system for measuring the intelligibility of speech processed through a communications channel. The major components of the intelligibility measurement system include an audio test tape of fifty phonetically balanced (PB) words, a bank of twelve audio bandpass filters, an audio power detector, and a microprocessor. A time-frequency matrix of the starting and ending phonemes of each PB word is stored in memory as the reference. The system works by inputting a recording of the audio test tape as received over a communications channel. Timing marks included within the audio test tape allow comparison of the time-frequency history of the test tape. This comparison of the reference values with the test data yields an intelligibility score. Initial tests of the automatic intelligibility measurement system promise performance which will be superior to that of existing automated techniques. GRA

N81-20810# Forschungsinstitut fuer Informationsverarbeitung, Karlsruhe (West Germany).
A FLEXIBLE IMAGE PROCESSING SYSTEM
Peter Gemmar, Hartmut Ischen, and Karl Luetjen *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 10 p ref (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

N81-20815# Royal Signals and Radar Establishment, Malvern (England).
A DETECTION AND PROCESSING SCHEME FOR MOVING TARGET DETECTION USING A PASSIVE SENSOR
Charles M. Henderson *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 11 p (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

N81-20825# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Avionics Lab.
A SYSTEM LOOK AT REAL TIME PROCESSING FOR TARGET ACQUISITION AND CLASSIFICATION
Henry Lapp *In* AGARD Image and Sesor Data Process. for Target Acquisition and Recognition Nov. 1980 9 p refs (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N81-20740 Wisconsin Univ. - Madison.
GUARANTEED COMPONENT-WISE POINT-WISE ERROR BOUNDS FOR APPROXIMATE SOLUTIONS OF NONLINEAR TWO-POINT BOUNDARY VALUE PROBLEMS USING AN IMPROVED KANTOROVICH-LIKE THEOREM Ph.D. Thesis
Ying-Da Lee 1980 110 p
Avail: Univ. Microfilms Order No. 8023421

A collection of functionals called bounded seminorms is used to obtain an improved version of the Kantorovich theorem. The theorem can yield a variety of error bounds for approximate solutions of nonlinear operator equations, including component-wise error bounds for systems of nonlinear equations and component-wise point-wise error bounds for two-point boundary value problems. Along the way, a theorem on the convergence of the Neumann series expansion is also established. A basic theorem on unique solutions of linear two-point boundary value problems is derived and improved to simplify the computation in case some initial or final conditions are included as parts of the boundary conditions. These theoretical tools are combined with interval algorithms and interval arithmetic to form a procedure for computing guaranteed component-wise point-wise error bounds for nonlinear two-point boundary value problems. Computational results for five nonlinear two-point boundary value problems, each consisting of two to four differential equations, are shown. Dissert. Abstr.

N81-20741*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DESCRIPTION OF A DIGITAL COMPUTER SIMULATION OF AN ANNULAR MOMENTUM CONTROL DEVICE (AMCD) LABORATORY TEST MODEL
Charles T. Woolley and Nelson J. Groom Feb. 1981 22 p refs
(NASA-TM-81797) Avail: NTIS HC A02/MF A01 CSCL 09B

A description of a digital computer simulation of an Annular Momentum Control Device (AMCD) laboratory model is presented. The AMCD is a momentum exchange device which is under development as an advanced control effector for spacecraft attitude control systems. The digital computer simulation of this device incorporates the following models: six degree of freedom rigid body dynamics; rim warp; controller dynamics; nonlinear distributed element axial bearings; as well as power driver and power supply current limits. An annotated FORTRAN IV source code listing of the computer program is included. Author

N81-20742# General Research Corp., Santa Barbara, Calif.
THE ROSCOE MANUAL. VOLUME 2-1: SAMPLE CASE Final Report, 12 Dec. 1979 - 1 Mar. 1980
J. R. Gargarino 1 Mar. 1980 73 p
(Contract DNA001-80-C-0075)
(AD-A095535; GRC-CR-1-520-Vol-2-1; DNA-3964F-2-1) Avail: NTIS HC A04/MF A01 CSCL 09/2

The ROSCOE computer code is designed specifically to be the 'laboratory standard' for evaluating nuclear effects on radar and optical systems. The program provides a means for (1) evaluating sensor acquisition, discrimination, and tracking performance in a nuclear environment; (2) measuring various propagation error sources; and (3) computing specific phenomenological data. This volume, Volume 2-1, presents a description of sample problems utilizing the new ROSCOE data deck. Input and output options are discussed, and sample job control streams are provided. GRA

N81-20743# Systems and Applied Sciences Corp., Riverdale, Md.

STAR NETWORK DISTRIBUTED COMPUTER SYSTEMS EVALUATION RESULTS Final Report

N. DeMesa and I. Shola 12 Feb. 1981 93 p refs
(Contract DASG60-80-C-0010)
(AD-A095687; SASC-ADPSI-CD-013) Avail: NTIS HC A05/MF A01 CSCL 09/2

A software model for executive overhead has been developed for distributed processing with emphasis on ease of software development by isolation of synchronization and other topological details from the TAP tasks. Further, restrictive interfaces have been developed to assist in software validation and fault isolation. Six risk functions were created for design evaluation. Quantitatively, these functions have identified risks associated with distributed processing and central processing designs. Two types of hierarchical topologies have been presented as possible candidates for the BMD Underlay DPS. One topology is constructed from 4 MIPS minicomputers (GE FFP). The second topology is constructed from 1 MIPS microprocessors (IAPX432). The merits of the various topologies are analyzed by evaluating their corresponding risk functions. The BMD Underlay System has been identified as a conceptual hierarchical control and a physical hierarchical resource system. The major characteristics of these hierarchies have been summarized. The negative characteristics of a resource hierarchy are inescapable with the current definition of the BMD Underlay System. GRA

N81-20744# Stanford Univ., Calif. Dept. of Computer Science.

EFFICIENT ALGORITHMS FOR CERTAIN SATISFIABILITY AND LINEAR PROGRAMMING PROBLEMS Ph.D. Thesis

Bengt Ingemar Aspvall Sep. 1980 67 p refs
(Contract N00014-76-C-0330; Grants NSF MCS-77-23728; NSF IST-79-21977)
(AD-A095411; SU-STAN-CS-80-822) Avail: NTIS HC A04/MF A01 CSCL 12/1

We present efficient algorithms for certain of Linear Equations solving, Linear Programming, and SATisfiability testing. LE, LP, and SAT have all been studied in both the theoretical and the applied areas of Computer Science. Although many algorithms have been developed for these problems, there are large gaps between today's best algorithms and the best theoretical lower bounds. We do not eliminate these gaps, but instead present efficient algorithsm for LE, LP, and SAT (and for testing the truth of Quantified Boolean Formulas) for the cases in which there are at most two variables or literals per equation, inequality, or clause. These subcases seem to be the 'hardest' ones that are not as hard as the general problems. The algorithms for LE(2), 2-SAT, and 2-QBF are linear-time algorithms, and they are optimal except for constant factors. Our algorithm for the subcase of LP has a nonlinear worst-case bound, but the bound is better than for any general LP algorithm such as the polynomial-time algorithm by Khachiyan, and the algorithm seems to be of practical as well as theoretical importance. In the algorithms, we associate graphs with given problem instances. By performing searches on the graphs (in the LP case combined with a binary search technique), we contrast a solution or a satisfying truth assignment if one exists. GRA

N81-20745# Textron Bell Helicopter, Fort Worth, Tex.

THE DATA FROM AEROMECHANICS TEST AND ANALYTICS, MANAGEMENT AND ANALYSIS PACKAGE (DATAMAP). VOLUME 1: USER'S MANUAL Final Technical Report

Richard B. Philbrick Dec. 1980 280 p refs
(Contract DAAK51-79-C-0015; DA Proj. 1L1-62209-AH-76)
(AD-A095188; BHT-699-099-025-Vol-1; USAAVRADCOM19-TR-80-D-30-A) Avail: NTIS HC A13/MF A01 CSCL 09/2

The Data from Aeromechanics Test and Analytics Management and Analysis Package (DATAMAP) was designed and programmed as a computer software tool for data management and processing of large, time-based data bases. Particular attention is given to rotorcraft-related analyses. The package will process data stored in two basic formats. The first format is that used for the Operational Loads Survey (OLS) test data based and anticipated for use in planned flight test programs. The second format is more general; it accommodates various data structures common to analytical data bases. This particular input capability is demonstrated by an interface between the Rotorcraft Flight Simulation Program (C81) and DATAMAP. The package transfers selected data to a large, direct access disc file and maintains the data on a semi-permanent basis. Data are retrieved from this file, processed, and displayed interactively or in batch. Plot output is generated on a Tektronix 4014 or an incremental plotter (e.g., Calcomp). A small sample of available processing options includes amplitude spectrum, harmonic analysis, digital filtering, auto-spectral density, frequency response function, acoustic analyses, and blade static pressure and normal force coefficient derivations. This program will accommodate data from multiple sensors simultaneously for processing of functions with two geometric independent variables (e.g., chord and radius). The package is written entirely in FORTRAN. Package specifications require nonstandard FORTRAN coding to be used, but the package has been made as easily transportable as possible. GRA

N81-20746# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

A SESSION WITH TINKER: INTERLEAVING PROGRAM TESTING WITH PROGRAM DESIGN

Henry Lieberman and Carl Hewitt Sep. 1980 38 p refs
(Contracts N00014-75-C-0643; N00014-75-C-0522)
(AD-A095521; AI-M-577) Avail: NTIS HC A03/MF A01 CSCL 09/2

Tinker is an experimental interactive programming system which integrates program testing with program design. New procedures are created by working out the steps of the procedure in concrete situations. Tinker displays the results of each step as it is performed, and constructs a procedure for the general case from sample calculations. The user communicates with Tinker mostly by selecting operations from menus on an interactive graphic display rather than by typing commands. This paper presents a demonstration of our current implementation of Tinker. GRA

N81-20747# Intermetrics, Inc., Cambridge, Mass.

ADA TEST AND EVALUATION Final Report

6 Feb. 1981 168 p
(Contract MDA903-79-C-0497; ARPA Order 3341)
(AD-A095699; IR-663) Avail: NTIS HC A08/MF A01 CSCL 09/2

In June of 1979, following an extensive process of selection and revision, the Preliminary ADA language definition was published. As a means of further refining the language, it was decided to approach the prospective user community and solicit their comments and reactions. This report describes the methods used to gather and evaluate the many responses received, and discusses the more prominent issues raised. GRA

N81-20748# Pennsylvania Univ., Philadelphia. Dept. of Computer and Information Sciences.

MODULARITY IN NON-PROCEDURAL LANGUAGES THROUGH ABSTRACT DATA TYPES Ph.D. Thesis. Final Report

Rajeev Sangal 31 Aug. 1980 165 p refs
(Contract N00014-76-C-0416)
(AD-A095546) Avail: NTIS HC A08/MF A01 CSCL 09/2

This dissertation presents abstract data types as a means of introducing modularity in non-procedural languages. Non-procedural languages based on equational specifications have been proposed in recent years to improve programmer productivity reliability. Issues of structured programming (i.e., disciplined use of the control structure) have no meaning in the context of these languages because these are devoid of any control structure. Statements in a specification can be given in any order; the sequence of execution is determined after an analysis of the specification. Modularity, however, still remains an important issue in the context of these languages, as it allows specifications to be written and processed independently. Abstract data types are proposed as a means of introducing modularity. Notion of module for the specification of abstract data types is introduced and its denotational semantics is given. Nopal, a non-procedural language for the specification of testing of electrical circuits, has been chosen in which abstract data types are introduced

for modularity. The abstract data types also allow specification of virtual devices in testing. GRA

N81-20749# Inco, Inc., McLean, Va.
STANDARD SOFTWARE BASE RELEASE 3 Final Technical Report, 24 Sep. 1979 - 25 Sep. 1980
Gary Morgan Griffiss AFB, N.Y. RADC Jan. 1981 49 p
(Contract F30602-79-C-0262; AF Proj. 2183)
(AD-A095693; INCO/1138A-1080-TR-47-D/F;
RADC-TR-80-376) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report describes the work performed to expand the capabilities of the USAF Standard Software Base (SSB) supporting AN/GYQ-21(V) operations. The report discusses maintenance and improvements made to the baseline system, and the development and implementation of advanced capabilities and services. These improvements include refined interfaces with the AUTODIN network improvements to internal message routing and control, expansion of message storage capacities, improved user operating procedures and a preliminary interface capability with the Message Support System. Development efforts to improve baseline SSB capabilities include the introduction of a revised queue management structure, a new user function (REVIEW), and expansion of function-key operating procedures. GRA

N81-20750# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
ANALYSIS OF AN ASSEMBLAGE OF DISCS EMPLOYING INTERACTIVE GRAPHICS Final Report, Dec. 1977 - Sep. 1980
John B. Palmerton Dec. 1980 94 p refs
(DA Proj. 4A1-61101-A-91D)
(AD-A095735; WES-MP-GL-80-9) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report describes the development of a computer program entitled DISC. This computer program uses concepts of the distinct element method in that the kinematics of a system of particles (elements) are faithfully represented. The system of elements to be analyzed consists of a collection of individual elements with individual material properties rather than a continuum for which material properties apply throughout the system. The types of particles that can be accommodated by DISC consist of discs and bar-shaped elements. These particles are permitted to react with one another by touching, rolling, bouncing or sliding. Problems requiring a quasi-static solution or problems involving large velocities and displacement can be analyzed. In addition to extending the distinct element method to disc-shaped particles, extensive use was made of interactive graphics. Through interactive graphics, the user of the program is relieved of the usual difficulties involved in data preparation and the plotting of results. The mode of operation of the computer program is visual; i.e., pictures (or plots) of the system of disc-shaped elements are drawn on a cathode ray terminal. The program operates in a time-sharing environment. GRA

N81-20751# Defense Advanced Research Projects Agency, Arlington, Va.
PROCEEDINGS OF THE ADA DEBUT
Sep. 1980 128 p Proc. held in Washington, D.C., 4 - 5 Sep. 1980
(AD-A095569) Avail: NTIS HC A07/MF A01 CSCL 09/2

Military systems of the future will incorporate much more flexible and intelligent control logic. For example, new surveillance systems will have sophisticated algorithms for detecting, identifying, and locating targets; command and control systems will be able to pass target information to fire units very rapidly, essentially in real-time. We will have even more capable precision guided weapons than we have today. We will also be upgrading existing tanks, aircraft and other weapons with intelligent digital control systems to extend their useful life. Thus, the Ada program has been an effort to provide a high quality common programming language for these critically important military systems of the future. In summary, we would like to emphasize that the Ada language is extremely important to the U.S. Department of Defense and the Western Alliance. In our opinion, Ada will be used to develop our most important systems in the future. We expect Ada will be widely used throughout the U.S. and the European countries for commercial use as well as defense software, and that the Department of Defense in the U.S. will benefit significantly from the resulting availability of trained personnel and privately developed software. GRA

N81-20752# Oak Ridge National Lab., Tenn. Computer Sciences Div.
DATA FORMAT TRANSLATION ROUTINES
R. D. Burris Feb. 1981 36 p refs
(Contract W-7405-eng-26)
(ORNL/CSD/TM-137) Avail: NTIS HC A03/MF A01

A package of routines is described which permits the translation of data in PDP 8 formats to PDP 11 or DECsystem 10 formats or from PDP 11 format to DECsystem 10 format. Additional routines are described which permit the effective use of the translation routines in the environment of the Fusion Energy Division network and the Elmo Bumpy Torus data base. DOE

N81-20753# California Univ., Livermore. Lawrence Livermore Lab.
INTRODUCTION TO PRAXIS
James R. Greenwood, Arthur Evans, Jr. (Bolt, Beranek, and Newman, Inc.), C. Robert Morgan (Bolt, Beranek, and Newman, Inc.), and Michael C. Zamstorff (Wisconsin Univ., Madison) 3 Dec. 1980 31 p refs
(Contract W-7405-eng-48)
(UCRL-52957-Rev-1) Avail: NTIS HC A03/MF A01

Praxis is the practice of the programming art, science, and skill. It is a high order language designed for the efficient programming of control and systems applications. It is a comprehensive, strongly typed, block structured language in the tradition of Pascal, with much of the power of the Mesa and Ada languages. It supports the development of systems composed of separately compiled modules, user defined data types, exception handling, detailed control mechanisms, and encapsulated data and routines. Direct access to machine facilities, efficient bit manipulation, and interlocked critical regions are provided within Praxis. DOE

N81-20021# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
A QUICK-LOOK SYSTEM FOR THE PROCESSING OF FLIGHT DATA RECORDINGS
G.-J. Barth *In its* On Contrib. to 10th Symp. on Aircraft Integrated Data Systems Jun. 1980 p 353-371 refs In GERMAN; ENGLISH summary (For primary document see N81-20007 11-01)
Avail: NTIS HC A16/MF A01

N81-20809# National Aerospace Lab., Amsterdam (Netherlands).
IMAGE PROCESSING TECHNIQUES USING SPLINE APPROXIMATION
W. C. Huisman and J. vanKasteel *In* AGARD Image and Sensor Process. for Target Acquisition and Recognition Nov. 1980 14 p refs (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

N81-20813# Norwegian Defence Research Establishment, Kjeller.
IMAGE ENHANCEMENT IN REAL TIME
H. Yndestad *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 5 p refs (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

N81-20817# Etablissement Technique Central de l'Armement, Arcueil (France).
NUMERICAL TARGET TRACKING [POURSUITE NUMERIQUE DE CIBLES]
Michel Girard *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 8 p In FRENCH (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

N81-20824# Rome Air Development Center, Griffiss AFB, N.Y.
DIGITAL IMAGE PROCESSING FOR GROUND TARGET DETECTION, IDENTIFICATION AND LOCATION

George R. Hughes *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 7 p (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

62 COMPUTER SYSTEMS

Includes computer networks.

N81-20754 Northwestern Univ., Evanston, Ill.
PARALLEL SOLUTION OF LARGE SPARSE LINEAR EQUATIONS USING A PROCESSOR NETWORK Ph.D. Thesis
Sang-Chul Kang 1980 143 p
Avail: Univ. Microfilms Order No. 8104727

The feasibility of using a processor network in solving large sparse linear equations is discussed. A processor network is proposed consisting of inexpensive small computing elements each capable of executing its own independent program. In order to best exploit the parallelism, the solution algorithm must be reformulated into a parallel form allowing processors to work concurrently on more or less independent portions of the given problem. Performances of three paralled solution methods, called sequential, bordered block diagonal form (BBDF), and scheduling method, are evaluated. The results with realistic sample problems are presented. It is shown that the scheduling method allows the effective utilization of processors while the sequential and BBDF method show strong saturation tendencies at relatively low number of processors. A simulator for the proposed processor network is developed to aid in establishing the design requirements. The effects of processor speed, communication speed, and interconnection structure are investigated. Dissert. Abstr.

N81-20755 Maryland Univ., College Park.
AN ANALYTIC STUDY OF A SHARED DEVICE AMONG INDEPENDENT COMPUTING SYSTEMS Ph.D. Thesis
Alan Mink 1980 244 p
Avail: Univ. Microfilms Order No. 8105696

Tools for analyzing a special class of computer architecture consisting of a number of independent computing systems sharing a single resource are developed. An exact queueing model for this class of architecture is developed. This model is derived from the general theory of multiclass queueing networks. Computational algorithms for evaluating this model's performance measures are presented that are memory space efficient. Second, a heuristic approach is presented to approximate this queueing network model. The heuristic is based on approximating the flow of each resource and then treating the resources as independent queueing devices. This results in a simple approximate model that can be evaluated using an algorithm that is efficient in both memory space and computation time. An analysis using the approximate model is presented which investigates the effect of a modular expansion on the system. This analysis yields a useful relation between the number of additional independent computing systems and the incremental increase in capability of the shared resource required to maintain the existing level of system performance. Dissert. Abstr.

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N81-20756 Syracuse Univ., N. Y.
MULTIPLE FINITE SOURCE QUEUEING MODEL WITH FIXED PRIORITY SCHEDULING Ph.D. Thesis
M. Jeya Chandra 1980 175 p
Avail: Univ. Microfilms Order No. 8104515

A multiple finite source queueing model with a single server and fixed priority service discipline is investigated. Interarrival times have exponential density functions and service times have arbitrary distribution functions. A solution procedure containing a set of numerical algorithms is developed to obtain server utilization and the mean values of the waiting times per customer of different classes and the number of waiting customers of different classes. The imbedded Markov chain technique is used as the basic method of analysis of the model. After the elements of the transition probability matrix of the Markov chain, P, are generated, obtaining the steady state probabilities involves inversion of a large matrix. Numerical techniques are developed for inversion. Using these expressions recursive relations are derived for finding the values of steady state departure probabilities. The set of algorithms developed are extended to find time average marginal and joint probabilities of finding a certain number of waiting customers of different classes at the facility using Level Crossing Analysis. Dissert. Abstr.

N81-20757 Wisconsin Univ. - Madison.
A METHOD FOR ADAPTIVE PERFORMANCE IMPROVEMENT OF OPERATION SYSTEMS Ph.D. Thesis
David Stephen Reiner 1980 185 p
Avail: Univ. Microfilms Order No. 8023427

The role of learning techniques is explored, motivated by approaches in artificial intelligence, in the context of operating system control. The improvement of system performance through dynamic modification of system control parameters is focused on. The need for a methodological approach to the implementation of this type of adaptive control is discussed, and a system independent method is presented with emphasis on concomitant statistical techniques. The first two phases of the method serve to establish the environment for experimentation, and are followed by an experimental phase where alternative parameter settings are compared by experimenting on the actual system. A productive phase then uses the results of experimentation to modify important control parameters on a periodic basis, in order to respond to fluctuations in system load and performance. Two experiments on a UNIVAC 1100 System are described. CPU quantum allocations in a preemptive, multilevel feedback algorithm were the first control parameters to be modified. The second experiment, modifying core quantum allocations yielded significant results, which are discussed and analyzed.
Dissert. Abstr.

N81-20758 Florida Univ., Gainesville.
FUNCTIONAL SERIES IDENTIFICATION OF NONLINEAR SYSTEMS FOR ADAPTIVE CONTROL Ph.D. Thesis
Firman Dean King 1980 122 p
Avail: Univ. Microfilms Order No. 8105591

An extension of the Cameron-Martin functional series expansion for nonlinear systems is derived for the case where the input consists of Gaussian white noise superimposed on a deterministic function. A parameterization of the resulting representation is developed, with the parameters to be determined by a least-squares procedures from input and output data. The resulting identification procedure is implemented in a digital simulation, and a number of numerical experiments are conducted. The method is found to yield good identifications of real nonlinear systems under suitable assumptions on system memory.
Dissert. Abstr.

N81-20759 Michigan Univ., Ann Arbor.
FUNCTION SPACE VARIABLE METRIC METHODS WITH APPLICATIONS TO SINGULAR OPTIMAL CONTROL COMPUTATION Ph.D. Thesis
Nader Marwan Boustany 1980 185 p
Avail: Univ. Microfilms Order No. 8106105

The linear quadratic problem (LQP) in optimal control is formulated as an unconstrained quadratic functional minimization problem. This formulation allows the analysis of the problem in terms of the properties of the Hessian operator, L. Two special cases of the LQP, the LQP whose end points are conjugate and the infinite order singular LQP, are recognized as having closed range. Furthermore, it is shown that variable metric methods will converge in a finite number of iterates on infinite order singular LQPs. The conjugate gradient algorithm is derived using kernel polynomials and is shown to be optimal in a certain sense. The kernel polynomial formulation exposes the intimate relationship between the spectral structure of the Hessian operator and the performance of variable metric methods. This re-

lationship is used to advantage in deriving convergence and convergence rate results for the singular problem. Dissert. Abstr.

N81-20760*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Electrical Engineering.
SIMULATED LUMPED-PARAMETER SYSTEM REDUCED-ORDER ADAPTIVE CONTROL STUDIES
C. Richard Johnson, Jr., D. A. Lawrence, T. Taylor, and M. V. Malakooti Mar. 1981 118 p refs
(Contract NAG1-7)
(NASA-CR-163992; EE-8119) Avail: NTIS HC A06/MF A01 CSCL 09B

Two methods of interpreting the misbehavior of reduced order adaptive controllers are discussed. The first method is based on system input-output description and the second is based on state variable description. The implementation of the single input, single output, autoregressive, moving average system is considered.
R.C.T.

N81-20761*# Virginia Polytechnic Inst., Blacksburg. Dept. of Electrical Engineering.
THE REDUCED ORDER MODEL PROBLEM IN DISTRIBUTED PARAMETER SYSTEMS ADAPTIVE IDENTIFICATION AND CONTROL Progress Report
C. Richard Johnson, Jr. and Dale A. Lawrence Mar. 1981 49 p refs
(Grant NAG1-7)
(NASA-CR-164059; VPI-TR-EE-812; PR-2) Avail: NTIS HC A03/MF A01 CSCL 09B

The reduced order model problem in distributed parameter systems adaptive identification and control is investigated. A comprehensive examination of real-time centralized adaptive control options for flexible spacecraft is provided.
M.G.

N81-20762# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
DISTRIBUTED ROUTING Ph.D. Thesis
Art OLeary Jan. 1981 91 p refs
(Contract N00014-75-C-1183; NR Proj. 049-383; ARPA Order 3045)
(AD-A095385; LIDS-TH-1064) Avail: NTIS HC A05/MF A01 CSCL 09/2

In distributed routing each node receives some information about the network from its adjacent nodes and uses the information to determine the manner in which it forwards its traffic. This thesis gives three examples of distributed routing in a data communication network. A routing algorithm is then given where a generalized distributed routing procedure proposes a flow change and a central node determines the optimal scale of the proposed change. Small flows on long and unwanted paths are set to zero regardless of the scaling. The thesis shows that the iterative use of this algorithm converges to the optimal network cost, e.g., it minimizes the mean delay.
GRA

N81-20763# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
HYBRID APPROACHES AND INDUSTRIAL APPLICATIONS OF PATTERN RECOGNITION
K. S. Fu, J. Kittler (Oxford Univ., England), and L. F. Pau (George Washington Univ., Washington, D.C.) Oct. 1980 58 p refs
(Contract N00014-79-C-0574; Grant NATO-1639)
(AD-A095562; TR-EE80-43) Avail: NTIS HC A04/MF A01 CSCL 05/8

This report summarizes the major progress made during the support of NATO Research Grant 1639 on Hybrid Approaches to Pattern Recognition; Automatic Inspection by Lots in the Presence of Classification Errors; and Visual Screening of Integrated Circuits for Metallization Faults by Pattern Analysis Methods were discussed.
GRA

N81-20764# University of Southeastern Massachusetts, North Dartmouth. Dept. of Electrical Engineering.
IMAGE PROCESSING Annual Progress Report
C. H. Chen 16 Feb. 1981 12 p refs
(Contract N00014-79-C-0494; NR Proj. 042-422)
(AD-A095552) Avail: NTIS HC A02/MF A01 CSCL 12/1

This report is organized according to the topics we have worked under this project which include statistical image segmentation, two dimensional ARMA models, multichannel (multivariate) maximum entropy spectral analysis, and non-Gaussian signal processing, etc. Under each topic, the reports and papers published or presented are also listed. A new AED-512 Imaging/Graphics terminal has been installed in our PDP11/45 minicomputer. The use of the terminal for the image processing project research is also presented. Statistical image segmentation refers to the computer-oriented procedures that partition the image into meaningful parts by using the statistical pattern recognition techniques. A number of techniques have been studied, some of which are supervised while others are unsupervised. A critical evaluation of these techniques has been made. Furthermore we have performed an extensive computer study of the Fisher's linear discriminant method, maximum likelihood estimation and decision-directed method for image segmentation.
GRA

N81-20765# Yale Univ., New Haven, Conn. Dept. of Computer Science.
CONCEPTUAL INFORMATION RETRIEVAL
Roger C. Schank, Janet Kolodner, and Gerald DeJong Dec. 1980 53 p refs
(Contract N00014-75-C-1111)
(AD-A095372; RR-190) Avail: NTIS HC A04/MF A01 CSCL 09/2

If we want to build intelligent information retrieval systems, we will have to give them the capabilities of understanding natural language, automatically organizing and reorganizing their memories, and using intelligent heuristics for searching their memories. These systems will have to analyze and understand both new text and natural language queries. In answering questions, they will have to direct memory search to reasonable places. This requires good organization of both the conceptual content of text and knowledge necessary for understanding those texts and accessing memory. The CYRUS and FRUMP systems (Kolodner (1978), Schank and Kolodner (1979), Dejong (1979)) comprise an information retrieval system called CyFr. Together, they have the analysis and retrieval capabilities mentioned above. FRUMP analyzes news stories from the UPI wire for their conceptual content, and produces summaries of those stories. It sends summaries of stories about important people to CYRUS automatically adds those stories to its memory, and can then retrieve that information to answer question posed to it in natural language. This paper describes the problems involved in building such an intelligent system. It proposes solutions to some of those problems bases on recent research in Artificial Intelligence and natural language processing, and describes the CyFr system, which implements those solutions. The solutions we propose and implement are based on a model of human understanding and memory retrieval.
GRA

N81-20766# Engins Matra, Velizy (France). Lab. de Traitement des Images.
RANKING VARIOUS CLASSIFICATIONS OF THE SAME DATA FROM GROUND TRUTHS AND CONTINGENCY TABLES
Gabriel E. Lowitz and Jean M. Vivier Paris ESA Jul. 1980 18 p
(Contract ESTEC-3749/78)
(ESA-CR(P)-1388) Avail: NTIS HC A02/MF A01

An objective strategy to assess the comparative performances of various classifications of the same multispectral data using ground truth and contingency tables is described. Contingency tables are used as objective tools to assess the merit of a given classification strategy in terms of probabilities of correct classification, incorrect classification, and no classification. A factor of merit implies the knowledge of the cost of every type of error. This cost depends on applications. The heaviest cost is applied to misclassification errors and a smaller cost to the decision to refuse to classify when in doubt. When the cost is not available, a mini-max technique can be used setting n to that value which renders F extremum. Results of classification of NRL data are given in their raw forms, in their clustered compressed form, in their cascaded clustered form, and after interactive manipulation to improve the classification performances. Compressing the data is shwon to improve rather than degrade the supervised classification results.
Author (ESA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N81-20767 Wisconsin Univ. - Madison.
APPLICATIONS OF LOGIC TO FINITE COMBINATORICS Ph.D. Thesis
Kevin Jay Compton 1980 126 p
Avail: Univ. Microfilms Order No. 8020554

The asymptotics of classes whose members are arbitrary combinations of basic structures (the connected structures) in the class (the class of graphs is an example) are examined. These classes are syntactically characterized (i.e., show that the axioms for such classes are precisely those of a certain form) and related results about the language of these classes which are useful for computing asymptotic probabilities are proved. Two natural notions of asymptotic probability are considered: the labeled asymptotic probability, which is the limiting value of the fraction of structures with a fixed universe of size n that satisfy a sentence; and the unlabeled asymptotic probability defined similarly for isomorphism classes. It is shown that certain sentences, the component closed sentences have asymptotic probabilities if the classes satisfy certain asymptotic conditions. This is used to prove striking results about 01-laws. Finally, counterexamples to various conjectures about asymptotic probabilities are contracted. Dissert. Abstr.

N81-20768 California Inst. of Tech., Pasadena.
ASYMPTOTIC BOUNDARY CONDITIONS FOR ORDINARY DIFFERENTIAL EQUATIONS, 1. NUMERICAL HOPF BIFURCATION, 2 Ph.D. Thesis
Allan Douglas Jepson 1981 212 p
Avail: Univ. Microfilms Order No. 8105157

A hierarchy of increasingly accurate boundary conditions for the truncated interval problem is determined. Both linear and nonlinear problems are considered. Numerical techniques for error estimation and the determination of an appropriate truncation point are discussed. A Fredholm theory for boundary value problems on semi-infinite intervals is developed and used to prove the stability of the numerical methods. Several numerical methods for locating a Hopf bifurcation point of a system of o.d.e.'s or p.d.e.'s are discussed. A technique for computing the Hopf bifurcation parameters is also presented. Well known numerical techniques for simple bifurcation problems are adapted for Hopf bifurcation problems. This provides numerical techniques for computing the bifurcating branch of periodic solutions, possibly including turning points and simple bifurcation points. The stability of the periodic solutions is discussed. Dissert. Abstr.

N81-20769 Wisconsin Univ. - Madison.
ORBITS NEAR TRIPLE COLLISION IN THE THREE BODY PROBLEM Ph.D. Thesis
Richard Barry Moeckel 1980 60 p
Avail: Univ. Microfilms Order No. 8023423

Various analytical methods make it possible to study the qualitative behavior of orbits which pass near the triple collision singularity in the three body problem. The question reduces to a study of a gradient-like vectorfield on a four dimensional collision manifold. Orbits which begin or end in triple collision tend to restpoints of the vectorfield. By finding connections between the restpoints, it is possible to show the existence of orbits passing near collision which exhibit startling changes of configuration. Binary exchanges occur. Orbits can approach collision near a central configuration before one particle splits off and recedes indefinitely from the other two. Finally, orbits can approach collision near one central configuration and recede near a different one. Dissert. Abstr.

N81-20770 Maryland Univ., College Park.
A PROOF OF THE EXISTENCE OF UNSTABLE PERIODIC ORBITS USING COMPUTER-BASED TECHNIQUES Ph.D. Thesis
Ira Bruce Schwartz 1980 93 p
Avail: Univ. Microfilms Order No. 8105136

A systematic way of rigorously proving the existence of periodic solutions to a dynamical system using numerical techniques is presented. In particular, an n-dimensional ordinary differential equation, periodic in time, is considered and algorithm is developed to prove the existence of both stable and unstable periodic solutions with the use of ordinary differential equation solvers (implemented by computer) and a knowledge of their error bounds. The method used is based on a simple shooting method. A particularly difficult problem is considered in which the Lipschitz constant is large along solutions. This leads to a modified but still systematic scheme incorporating a multi-point shooting method to prove the existence of periodic solutions. The multi-point shooting method is then applied to a model in epidemiology to prove the existence of an unstable periodic solution. Dissert. Abstr.

N81-20771 Virginia Univ., Charlottesville.
THE MINIMAX FINITE-ELEMENT METHOD Ph.D. Thesis
Il-Bahng Park 1980 108 p
Avail: Univ. Microfilms Order No. 8102574

A minimax criterion is applied to the weighted residual method for the finite formulation for solid mechanics problems. Computational implementation is achieved using linear programming. For the finite element formulation, ordinary polynomials and Hemitian shape functions are used as basis functions of a trial function. Since inequality constraints are acceptable to a linear programming problem, the method can be used for limit analysis and offset support problems. For inequality constraint problems, a perturbation method, which can handle multiple objective functions, is used. Dissert. Abstr.

N81-20772# North Carolina Univ. at Chapel Hill. Inst. of Statistics.
THE CLOSENESS OF UNIFORM RANDOM POINTS IN A SQUARE AND A CIRCLE
D. J. Daley (Australian National Univ., Canberra) Feb. 1981 11 p
(Contract N00014-75-C-0809)
(AD-A095697; MIMEO-SER-1327) Avail: NTIS HC A02/MF A01 CSCL 12/1

It is far from clear how best to approximate one random vector (for example, a stochastic process observed at n consecutive time-points) by another random vector which may have for example a simpler stochastic structure. This problem is illustrated by seeking constructions of points P and Q uniformly distributed over concentric square and circle respectively and of unit area. GRA

N81-20773# Harvard Univ., Cambridge, Mass. Computation Lab.
THE COMPLEXITY OF PROVABLE PROPERTIES OF FIRST ORDER THEORIES
Steve Homer (DePaul Univ., Chicago) and John H. Reif 1980 17 p refs
(Contract N00014-80-C-0647; Grant NSF MCS-78-21024)
(AD-A095656; TR-21-80) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper considers first order quantified and modal theories with the interpretation of function and predicate symbols restricted to fixed r.e. sets of functions F and predicates R. We characterize functions with certain properties (such as totality, monotonicity, unboundedness) provable in these theories. In the case F and R are restricted to a complexity class (such as polynomial time), our results give a characterization of complexity hierarchies (such as the polynomial time hierarchy of Stockmeyer in terms of strength of theories whose axioms have restricted quantification. In addition we construct formulas for which probability in these theories implies the collapse of the corresponding complexity hierarchy. We consider modal theories as well as purely quantified theories. Because modal formulas can encode arbitrary alternations of quantifiers, probability of certain formulas in these modal theories implies the collapse of complexity hierarchies with unbounded alternation. This is applied to the P = (questionably) PSPACE problem. GRA

N81-20774# Harvard Univ., Cambridge, Mass. Aiken Computation Lab.
MINIMUM S-T CUT OF A PLANAR UNDIRECTED NETWORK IN O(N LOG2(N)) TIME
John H. Reif 1980 22 p refs

(Contract N00014-80-C-0647; Grant NSF MCS-79-21024)
(AD-A095539; TR-20-80) Avail: NTIS HC A02/MF A01 CSCL 12/1

We have presented an algorithm for computing a minimum S-T cut of a planar undirected network. Our algorithm runs in an order of magnitude less time than previous algorithms for this problem. An additional attractive feature of this algorithm is its simplicity, as compared to certain other algorithms for computing minimum S-T cuts for sparse networks. GRA

N81-20775# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
THE TRAVELING SALESMAN (0,2) MATCHINGS
Gerard Cornejols and William Pulleyblank (Calgary Univ., Canada) Feb. 1981 39 p refs Sponsored in part by Bonn Univ. and National Science and Engineering Research Council of Canada
(Contract N00014-75-C-0621; Grant NSF ENG-79-02508)
(AD-A095716; MSRR-470; REPT-80172-OR) Avail: NTIS HC A03/MF A01 CSCL 12/1

A (0,2) matching is an assignment of the integers 0,2 to the edges of a graph G such that for every node the sum of the integers on the incident edges is at most two. A tour is the 0-1-incidence vector of a hamilton cycle. We study the polytope P(G), defined to be convex hull of the (0,2) matchings and tours of G. When G has an odd number of nodes, the travelling salesman polytope, the convex hull of the tours, is a facet of P(G). We obtain the following results: (1) we completely characterize those facets of P(G) which can be induced by an inequality with 0-1-coefficients; (2) we prove necessary properties for any other facet inducing inequality and exhibit a class of such inequalities with the property that for any pair of consecutive positive integers, there exists an inequality in our class whose coefficients include these integers; (3) we relate the facets of P(G) to the facets of the travelling salesman polytope. In particular, we show that for any facet F of the travelling salesman polytope, there is a unique facet of P(G) whose intersection with the travelling salesman polytope is exactly F. GRA

N81-20776# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
FINITE ELEMENTS FOR INITIAL VALUE PROBLEMS IN DYNAMICS
T. E. Simkins Dec. 1980 34 p refs
(DA Proj. 1L1-61102-AH-60)
(AD-A095344; AD-E440107; ARLCB-TR-80047) Avail: NTIS HC A03/MF A01 CSCL 12/1

The work of C. D. Bailey amply demonstrates that a variational principle is not a necessary prerequisite for the formulation of variational approximations to initial value problems in dynamics. While Bailey successfully applies global power series approximations to Hamilton's Law of Varying Action, the work herein shows that a straightforward extension to finite element formulations fails to produce a convergent sequence of solutions. The source of the difficulties and their elimination are discussed in some detail and a workable formulation for initial value problems is obtained. The report concludes with a few elementary examples showing the utility of finite elements in the time domain. GRA

N81-20777# Aeronautical Research Associates of Princeton, Inc., N. J.
STUDIES IN NONLINEAR MOTION Final Report, 1 Jan. 1978 - 31 Dec. 1980
Harvey Segur Jan. 1981 5 p refs
(Contract DAAG29-78-C-0003; DA Proj. 1L1-61102-BH-57)
(AD-A095559; ARAP-434; ARO-15338.9-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

The most important result of this research has been the development of exploitation of the connection between nonlinear evolution equations solvable by some Inverse Scattering Transform (IST) and ordinary differential equations of Painleve-type. This connection provides a test (or series of tests) which a given evolution equation must pass if it is solvable by IST. Being a necessary condition, it complements the various sufficient conditions that already were known. Independently, the connection also can be used to obtain global information about the classical Painleve transcendents. This information becomes increasingly important as these equations are discovered more and more frequently in models of physical problems. GRA

N81-20778# Oak Ridge National Lab., Tenn.
SOLUTION OF HOMOGENEOUS SYSTEMS OF LINEAR EQUATIONS ARISING FROM COMPARTMENTAL MODELS
R. E. Funderlic and J. B. Mankin Dec. 1980 27 p refs
(Contract W-7405-eng-26)
(ORNL/CSD-70) Avail: NTIS HC A03/MF A01

Systems of linear differential equations with constant coefficients, Ax = x-dot, with the matrix A having nonnegative off-diagonal elements and zero column sums occur in compartmental analsis. The steady state solution leads to the homogeneous system of linear equations Ax(infinity) = x-dot(infinity) = 0. The LU factorization, the Crout algorithm, error analysis, and solution of a modified system are treated. DOE

N81-20779# California Univ., Livermore.
NEW FORMULATION OF BACKWARD DIFFERENCED LINEAR MULTISTEP METHODS FOR ORDINARY DIFFERENTIAL EQUATIONS
Alan M. Winslow 2 Oct. 1980 9 p refs
(Contract W-7405-eng-48)
(UCID-18825) Avail: NTIS HC A02/MF A01

The ordinary differential equation dy/dt = f(y,t) is integrated numerically by a k-th/order linear multistep method. Backward differencing is chosen for application to stiff equations. The novel feature of the formulation is the manner in which the history array is stored. The method was applied to the numerical solution of systems of chemical kinetics equations. DOE

N81-20780# California Univ., Livermore. Lawrence Livermore Lab. Dept. of Applied Science.
ALTERNATING-DIRECTION IMPLICIT NUMERICAL SOLUTION OF THE TIME DEPENDENT, THREE-DIMENSIONAL, SINGLT FLUID, RESISTIVE MAGNETOHYDRODYNAMIC EQUATIONS Ph.D. Thesis
Charles Henry Finan, III Dec. 1980 247 p refs
(UCRL-53086) Avail: NTIS HC A11/MF A01

Resistive magnetohydrodynamics (MHD) is described by a set of eight coupled, nonlinear, three dimensional, time dependent, partial differential equations. A computer code, IMP (Implicit MHD Program), has been developed to solve these equations numerically by the method of finite differences on an Eulerian mesh. In this model, the equations are expressed in orthogonal curvilinear coordinates, making the code applicable to a variety of coordinate systems. The Douglas-Gunn algorithm for Alternating-Direction Implicit (ADI) temporal advancement is used to avoid the limitations in timestep size imposed by explicit methods. The equations are solved simultaneously to avoid syncronization errors. DOE

N81-20781# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
ON BOUNDS FOR THE SPECIFICATION OF FINITE DATA TYPES BY MEANS OF EQUATIONS AND CONDITIONAL EQUATIONS
J. A. Bergstra (Leiden Univ., Netherlands) and J. V. Tucker Mar. 1980 27 p refs Submitted for publication
(MC-IW-131/80) Avail: NTIS HC A03/MF A01

Within the framework of initial algebraic semantics for data types, it is proved that while any finite data type can be specified by means of a finite number of equations, the number of equations required is a function of the size of the data type. By using hidden operators, however, the number of equations needed to specify a finite data type A can be proved to be bounded by numbers depending only on the signature Sigma of A. For example, if A is any finite single-sorted data type, generated by p initial values and having q operations, then A can be specified using one hidden constant, six hidden functions and 15 + p + q equations. It is also provied that such a data type A can be specified using one hidden function, one equation, and two conditional equations. Author (ESA)

N81-20782# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Numerical Analysis and Computing Science.
ON THE DETERMINATION OF BOUNDARY COLLOCATION

POINTS FOR SOLVING SOME PROBLEMS FOR THE LAPLACE OPERATOR
Lothar Reichel 1980 33 p refs
(TRITA-NA-8006) Avail: NTIS HC A03/MF A01

Boundary collocation is discussed. The method is used to obtain an approximate solution of boundary problems for linear partial differential equations for which complete families of particular solutions are explicitly known. The method involves making decisions on factors such as the choice of solution subspace, the choice of a basis for this subspace, and the choice of collocation points. The determination of collocation points is investigated with a model. Author (ESA)

N81-20783# Loughborough Univ. of Technology (England). Dept. of Mathematics.
INFINITE FREQUENCY INTERPRETATIONS OF MINIMAL BASES
A. C. Pugh and P. A. Ratcliff (Plymouth Polytechnic) Mar. 1980 17 p refs
(Math-Res-148) Avail: NTIS HC A02/MF A01

The relevance of minimal bases in infinite frequency considerations is shown to lie more in the aspect of factorizations of rational matrices than in their characterization of the absence of zeros (finite and infinite). A definition of infinite poles and zeros is adopted which is consistent with that used for their finite counterparts. With this definition it is shown that row (or column) properness does not possess the interpretation of relative primeness at infinity, or rather of a lack of zeros at infinity, which has been ascribed to it elsewhere using an alternative definition. Author (ESA)

N81-20784# Loughborough Univ. of Technology (England). Dept. of Mathematics.
AN ASYMPTOTIC EXPANSION FOR THE DISTRIBUTION OF THE LOCATION LINEAR DISCRIMINANT FUNCTION
I. G. Vlachonikolis Apr. 1980 11 p refs
(Math-Res-149) Avail: NTIS HC A02/MF A01

The location model for the discriminant analysis problem with mixtures of continuous and binary variables is proposed. At each cell defined by the binary variables a discriminant function linear in the continuous variables is fitted with the cut-off point depending on the cell probabilities. An extension of previous results, concerning the distribution of the cell discriminant function, is presented. Author (ESA)

N81-20819# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
A REAL-TIME VIDEO TRACKING SYSTEM BASED ON BAYES RULE
W. Weimer, W. Laier, and E. Keller *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 11 p refs (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N81-20785 Syracuse Univ., N. Y.
A MONTE CARLO COMPARISON OF ROBUST AND RESISTANT ESTIMATORS OF BIVARIATE CORRELATION Ph.D. Thesis
Bernadette Bonnie Baranowski 1980 194 p
Avail: Univ. Microfilms Order No. 8104510

A Monte Carlo investigation of robust correlation estimators was conducted. Contaminated bivariate normal distributions were used to simulate distributions with longer than Gaussian tails. Four contaminate situations were examined; contaminate probabilities were set at .10 and .25 for standard deviations of 2 and 3. Correlations of .9, .6, .3 and .0 and samples of size 20 and 40 were used. The first stage of the study considered estimators which are based on a preliminary regression fit--the bisquare correlation coefficient and the use of residual analysis as a basis for trimming observations prior to the calculation of a Pearson correlation coefficient. The second stage compared six robust correlation estimators: the averaged bisquare from the first stage, the Tukey correlation, the standardized sums and differences, biweight standardized sums and differences, the transform Spearman's rho and a bivariate trimmed Pearson. Two real data examples are given for the robust procedures.
Dissert. Abstr.

N81-20786 Florida Univ., Gainesville.
ON A CLASS OF MULTIVARIATE EXPONENTIAL DENSITIES Ph.D. Thesis
Nancy Jean Shafer 1980 139 p
Avail: Univ. Microfilms Order No. 8105611

Several multivariate geometric distributions are created using the theory of Markov chains. These multivariate geometric distributions are then used to generate a variety of multivariate exponential distributions of either an absolutely continuous type or a type composed of both a singular component and an absolutely continuous component. The moment generating functions, covariances and distributions of the minimum of a set of variables are found for both types of multivariate exponential distributions. Dissert. Abstr.

N81-20787 Wisconsin Univ. - Madison.
ASPECTS OF EFFICIENCY ROBUST ESTIMATION OF LOCATION Ph.D. Thesis
David Lynn Hall 1980 216 p
Avail: Univ. Microfilms Order No. 8025823

Several different but related aspects of location estimators that are robust of efficiency are examined. M, L, and R estimators are considered and their similarities and differences, especially in terms of how they use the data and - 1/f, are explored. Formulas that express the asymptotic relative efficiency for pairs of estimators as correlation coefficieny are presented. These formulas are used to compute the asymptotic relative efficiencies for all pairs of optimal R estimators corresponding to a class of forty-five distributions. The asymptotic relative efficiency of rank estimators is used to define a distance measure between distributions. Low dimensional representations of the space of the forty-five distributions are found using multidimensional scaling on the collection of pair-wise distances. Interpretations and uses of these representations are presented. The geometry of the space of distributions induced by rank score functions is used to derive formulas for the maximin rank estimator for three or more distributions. An adaptive rank estimator based on the distance measure is defined and some of its asymptotic properties studied. Dissert. Abstr.

N81-20788 Wisconsin Univ. - Madison.
TESTS FOR DEPENDENCE IN MULTIVARIATE OBSERVATIONS Ph.D. Thesis
Thore Langeland 1980 214 p
Avail: Univ. Microfilms Order No. 8023419

Problems of testing for dependence among multivariate observations are considered. Tests of serial independence in univariate and multivariate data are surveyed and a test is introduced for testing against first order serial dependence. The test statistic is calculated from a linear combination of the variables. This linear combination test (LCT) statistic is the lag 1 correlation of the linear combination that possesses the maximum possible correlation. The asymptotic null distribution is derived using a relationship between certain multiple integrals of a determinant and the Pfaffian of a skew symmetric matrix. Small sample properties of the LCT statistics are compared with those of the normal theory likelihood ratio test. Next, the asymptotic distributions of the LCT and approximate likelihood ratio test are shown to be appropriate for the problem of testing for serial dependence among error terms in multivariate linear models. The ideas of contiguity of probability measures is employed to study the asymptotic efficiency of tests, for multivariate p order autoregressive process, when the error distribution is non normal. Dissert. Abstr.

N81-20789 Iowa State Univ. of Science and Technology, Ames.
ASPECTS OF SYMMETRIC BAYESIAN SEQUENTIAL DECISION PROBLEMS Ph.D. Thesis
Anuchit Lamyordmakpol 1980 79 p
Avail: Univ. Microfilms Order No. 8106021

Bayesian sequential decision problems with a finite number

of states of nature, a finite number of actions, and a finite number (in particular one and two) of sources of information are addressed. The results involve the introduction of the concepts of problem symmetries, effective N truncation, effective nontruncation, and source expendability. General conditions for certain problems with one source of information to be effectively nontruncated are given. More specific conditions involving sampling cost, final decision loss, and binomial likelihoods are given as well for a sequential binomial decision problem to be effectively 1-truncated. The main result for two source problems is motivated by the concept of uniform inequality of risk functions for fixed sample size Bayesian decision problems. It is shown, in the binomial case with equal sampling costs, that a standard condition for fixed sample size source expandability also applies in the sequential case. It is shown as well by example that a source that is expendable in the short run need not be expendable in the long run. Problem symmetry is discussed. Dissert. Abstr.

N81-20790 Iowa State Univ. of Science and Technology, Ames.
CONTRIBUTIONS TO SURVEY SAMPLING AND DESIGN OF EXPERIMENTS Ph.D. Thesis
Chand Krishan Midha 1980 170 p
Avail: Univ. Microfilms Order No. 8106031

The theory of sampling with unequal probabilities is addressed. Several estimators for the variance of the Horvitz-Thompson estimator of the population total are available in the literature. The stability of the several estimators is compared numerically, by means of analytic expressions for the variances of these estimators. Also, the stability is compared using as a criterion the mean square error of each estimator based on all possible samples of size n. An empirical study is made of the distribution of standardized (Studentized) estimates and average widths of confidence intervals obtained using different estimators of the variance of the Horvitz-Thompson estimator. In addition, the construction of Partially Balanced Incomplete Block (PBIB) designs are discussed. Some combinatorial matrices, viz., Generalized Balanced Matrices (GBM) and Strongly Balanced Matrices are used to obtain two associate and higher associate PBIB designs. Several methods of construction of GBM's are given. Dissert. Abstr.

N81-20791 Pennsylvania State Univ., University Park.
SIMPLE ESTIMATION PROCEDURES BASED ON RANK TESTS FOR THE ONE- AND TWO-SAMPLE LOCATION MODELS Ph.D. Thesis
Edward Philip Markowski 1980 128 p
Avail: Univ. Microfilms Order No. 8105761

A class of estimation procedures which are robust, relatively efficienct, and yet computationally simple is proposed for the one and two sample location problems. Particular emphasis is placed on the problem of determining confidence intervals with the properties stated above. As a by-product, some interesting point estimates are obtained. A class of score functions which are ordinary step functions is considered for the one sample location model. Point estimates and confidence intervals are obtained by inverting the corresponding rank statistics. Efficiency and robustness properties of the procedures are investigated. Several computational schemes are illustrated which make the estimates and confidence intervals quite easy to compute. When the underlying family of distribution remains unspecified, another procedure is recommended. In addition, it is shown that two asymptotically equivalent methods of determining confidence intervals can be very different for small to moderate sample sizes. Finally all the previous results are extended to the two sample location problem. Dissert. Abstr.

N81-20792# Maryland Univ., College Park. Computer Vision Lab.
ON THE USE OF HIERARCHICALLY COMPUTED 'MEXICAN HAT' FEATURES FOR TEXTURE DISCRIMINATION
Matti Pietikainen Nov. 1980 17 p refs
(Grant AF-AFOSR-3271-77; AF Proj. 2304)
(AD-A095718; TR-968; AFOSR-81-0139TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

Bandpass Laplacian-like operators derived by a hierarchical discrete correlation technique provide natural measures of texture coarseness. This performance of these measures on a standard set of geological terrain types is comparable to that of conventional texture features that do not use directional information. GRA

N81-20793# North Carolina Univ. at Chapel Hill. Inst. of Statistics.
ON A CLASS OF MULTIVARIATE NEGATIVE BINOMIAL DISTRIBUTIONS
R. K. Milne (Western Australia Univ., Perth) Dec. 1980 29 p refs
(Contract N00014-75-C-0809)
(AD-A095445; MMS-1319) Avail: NTIS HC A03/MF A01 CSCL 12/1

The negative binomial distribution arises in probability as the distribution of the waiting time to achieve a specified number of successes in a sequence of Bernoulli trials. In addition, it has been widely used in statistics as a model for a variety of data involving counts. Multivariate analogues of the negative binomial distribution are of interest as joint distributions of waiting times in Bernoulli trials and for modelling data involving pairs or m-tuples of possibly dependent counts. This paper considers m-variate distributions concentrated on Z(-) superscript m is identical to (Z(-)) superscript m where Z(-) = (0,1,2,...) and having negative binomial univariate marginal distributions. Such distributions will be called multivariate/m-variate negative binomial distributions. It is not hard to see that distributions of this form do not, for any fixed m, exhaust the class of all m-variate negative binomial distributions. Several types of counterexample can be constructed. GRA

N81-20794# Technology Service Corp., Santa Monica, Calif.
FURTHER DEVELOPMENT OF NEW METHODS FOR ESTIMATING TAIL PROBABILITIES AND EXTREME VALUE DISTRIBUTIONS Final Report
L. Breiman Jan. 1981 108 p refs
(Contract F49620-80-C-0037; AF Proj. 2304)
(AD-A095721; TSC-PD-A243-1; AFOSR-81-0136TR) Avail: NTIS HC A06/MF A01 CSCL 12/1

This research has focused on the problem of obtaining confidence intervals for extreme quantiles based on a random sample from a distribution of unknown form. Three confidence interval procedures were studied, both analytically and by means of an extensive Monte Carlo experiment. The experiment involved three sampled sizes (100, 200, 400) and twenty underlying distributions (five Weibulls, five mixed Weibulls, five lognormals, five mixed lognormals). The Monte Carlo results show that all three procedures studied work quite well and point the way to further improvement. GRA

N81-20795# Naval Ocean Systems Center, San Diego, Calif.
STATISTICS FOR PEAK VALUES OF MULTIPLE COHERENCE Final Report, 1 Oct. 1979 - 30 Sep. 1980
D. M. Klamer 28 Sep. 1980 39 p refs
(XF11101100)
(AD-A095460; NOSC/TR-628) Avail: NTIS HC A03/MF A01 CSCL 12/1

The objective of this work is to determine the performance of the maximum (or peak) of estimates of the magnitude-squared coherence (MSC) on a passive ambiguity surface as a detection statistic. The method chosen to measure the objective was the receiver operating characteristic (ROC) curves which plot the probability of detection versus the false alarm rate. To obtain the ROC curves, the probability distribution function of the maximum value of the MSC estimates for noise only, along with noise and signal present, are developed. These probability distribution and density functions are then used to establish a Neyman-Pearson hypotheses test for signal detection. The signal detection results are presented as ROC curves which depend on the size of the surface over which the maximum is taken, the true coherence, and the number of degrees of freedom of the individual estimates of the MSC. These results are then extended to multiple coherence. GRA

N81-20796# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Statistics.
BAYESIAN OPTIMAL DESIGNS FOR SURVEILLANCE PROCEDURES IN ATTRIBUTE LIFE TESTING
Mohammad Kazim Khan and S. Zacks 15 Dec. 1980 37 p refs

(Contract N00014-80-C-0325)
(AD-A095723; VPI-TR-4) Avail: NTIS HC A03/MF A01 CSCL 12/1

Design of experiments for estimation of parameters in non-linear models is studied in a Bayesian framework, with the objective of maximization of the anticipated Fisher information. Two stage optimal designs are proposed in attribute life situations. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N81-20797*# Rockwell International Corp., Downey, Calif. Space Operation and Satellite Systems Div.
SPACE CONSTRUCTION SYSTEM ANALYSIS. PART 2: EXECUTIVE SUMMARY Final Report
Jun. 1980 88 p
(Contract NAS9-15718)
(NASA-CR-160902; SSD-80-0041) Avail: NTIS HC A05/MF A01 CSCL 12B

A detailed, end-to-end analysis of the activities, techniques, equipment and Shuttle provisions required to construct a reference project system is described. Included are: platform definition; construction analysis; cost and programmatics; and space construction experiments concepts. S.F.

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N81-20798 Wisconsin Univ. - Madison.
SOME PROBLEMS IN COMBINATORIAL MATRIX THEORY Ph.D. Thesis
Jeffrey Alan Ross 1980 128 p
Avail: Univ. Microfilms Order No. 8023429

Some combinatorial problems involving matrices are investigated. These problems are approached by considering various graphs and hypergraphs that can be associated with matrices whose entries are zeros and ones. Associated with a square matrix of zeros and ones with total support is its diagonal hypergraph, the hypergraph whose vertices are the positive positions of the matrix and whose edges are the positive diagonals of the matrix. Matrices which have diagonal hypergraphs isomorphic to that of a given matrix are investigated along with the structure of such isomorphisms. This is accomplished by deriving properties of the strongly stable sets of diagonal hypergraphs, since for such hypergraphs the strongly stable sets determine the hypergraph. The class of m x n matrices of zeros and ones with specified row and column sums is examined. A sample proof of Ryser's formula for the maximum term rank of a matrix in the class is given. The exponent of a primitive, nearly reducible matrix, is also investigated. Dissert. Abstr.

N81-20799# North Carolina State Univ., Raleigh. Operations Research.
OPTIMAL LINEAR APPROXIMATION IN PROJECT COMPRESSION
S. E. Elmaghraby and A. M. Salem Jan. 1981 52 p refs
(Contract DAAG29-79-C-0211; Grant NSF ENG-78-13936)
(AD-A095757; NCSU-OR-171; ARO-16352.8-M) Avail: NTIS HC A04/MF A01 CSCL 12/2

When the cost of reducing the duration of activities is convex and nonlinear, it may be advisable (to reduce the computing burden) to seek a 'satisfying answer' in which the project is compressed to a desired completion time with prespecified tolerable relative error. We treat the problem of constructing the optimal first degree interpolating linear spline that guarantees such maximal error, and consider various possible refinements. GRA

N81-20800# George Washington Univ., Washington, D.C. Inst. for Management Science and Engineering.
CONTINUITY OF THE OPTIMAL VALUE FUNCTION UNDER THE MANGASARIAN-FROMOVITZ CONSTRAINT QUALIFICATION
Anthony V. Fiacco 4 Dec. 1980 22 p refs
(Contract DAAG29-79-C-0062)
(AD-A095422; SERIAL-T-432; ARO-16229.7-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

We demonstrate the continuity of the optimal value of general inequality-constrained parametric nonlinear programs having a solution point that satisfies the Mangasarian-Fromovitz Constraint Qualification (MFCQ). This result is applied to prove the continuity of the optimal value function for general inequality-equality parametric programs under MFCQ, by using a variable reduction approach. An abstract set (not defined by functional inequalities or equalities) is allowed to enter (nontrivially into the definition of the feasible region and results regarding the behavior of the parameter dependent feasible region and solution set are also obtained. GRA

N81-20801# Loughborough Univ. of Technology (England). Dept. of Mathematics.
A SPIN COEFFICIENT APPROACH TO WEYSSENHOFF FLUIDS IN EINSTEIN-CARTAN THEORY
J. B. Griffiths and S. Jogia Oct. 1980 21 p refs
(Math-Res-153) Avail: NTIS HC A02/MF A01

The generalized Newman-Penrose formalism was used to analyze semiclassical aligned spin fluids satisfying the Weyssenhoff restriction in the framework of Einstein-Cartan theory. General properties were derived and the formalism was then used to obtain two classes of exact solution. One has a flat metric, but the fluid has in general non-zero acceleration, expansion and shear. It is characterized by two arbitrary constants and two functions of two variables satisfying one partial differential equation. In the other class, the fluid has nonzero acceleration and vorticity, and the free gravitational field is of type D. It is characterized by three arbitrary constants and an arbitrary function of one spacelike coordinate. Author (ESA)

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N81-20802*# National Aeronautics and Space Administration, Washington, D. C.
SOME ASPECTS OF THE COMPARISON BETWEEN OPTICS AND NONLINEAR ACOUSTICS
B. Perrin Oct. 1980 12 p refs Transl. into ENGLISH from J. de Phys. (France), v. 40, no. 11, colloq. C8, Nov. 1979 p 216-220 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Pierre and Marie Curie Univ., Paris
(Contract NASw-3199)
(NASA-TM-75859) Avail: NTIS HC A02/MF A01 CSCL 20A

Some results concerning nonlinear acoustics deduced from a comparison of nonlinear processes in optics and acoustics are discussed. An aspect of nonlinearity in acoustics connected with the dimensionality of the medium of propagation is emphasized and illustrated by the proof of static instability of an ideal linear solid. In addition a phenomenon, which can be called acoustical rectification by analogy with nonlinear optics, is propounded to measure the third order elastic constants. Its experimental consequences are predicted in a particular case. M.G.

N81-20803# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
IMAGE AND SENSOR DATA PROCESSING FOR TARGET ACQUISITION AND RECOGNITION
Nov. 1980 263 p refs In ENGLISH and FRENCH Proceedings of the 40th Tech. Meeting of the Avionics Panel of AGARD, Aalborg, Denmark, 8-12 Sep. 1980
(AGARD-CP-290; ISBN-92-835-0280-9) Avail: NTIS HC A12/MF A01

Efforts to enhance the visibility of targets to be detected

and identified are examined as well as limitations to the solutions proposed. Topics covered include: target backgrounds and visibility; man machine interactions; image processing, target tracking; and tag target classification and identification. For individual titles, see N81-20804 through N81-20825.

N81-20804# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphere.

THE OPTICAL CONTRAST OF LAND AND SEA TARGETS **c74**

H.-E. Hoffman *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 10 p refs (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

In the last years the DFVLR has carried out field experiments for determining the visibility ranges maximum detection range, maximum recognition range or maximum identification range when observing ground to air or air to ground with different observation devices. During visibility tests in Northern Germany in summer and autumn 1977 the inherent contrast of a 1.5 t lorry and a minesweeper-type test boat belonging to the Bundeswehr were also measured. The measurements were taken using a photopic adapted photometer installed in a Bell UH 1D helicopter. Some of these measurement results are presented in diagrams and give information on the influence of the following parameters on the inherent contrast of both the land respectively sea targets: background illumination of target area, angle of elevation, time of day, parts of target, degree of cloud cover, angle of azimuth. Author

N81-20805# Naval Air Development Center, Warminster, Pa.

AN APPROACH TO AIRBORNE INFRARED SEARCH SET PERFORMANCE MODELING **c74**

Nancy E. MacMeekin *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 10 p refs (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

An airborne search set mathematical model is described which predicts sensor performance in terms of probabilities of detection and false alarm in addition to calculating signals available for processing by the sensor. Inputs and submodels which describe and/or calculate target signatures, backgrounds, atmospheric effects and sensor design are discussed. Sensor performance is illustrated for several atmospheric conditions. Author

N81-20806# Etablissement Technique Central de l'Armement, Arcueil (France).

TARGET DETECTION AND CLASSIFICATION IN INFRARED IMAGERY [DETECTION ET CLASSIFICATION DE CIBLES EN IMAGERIE INFRA-ROUGE] **c74**

Jean Louchet *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 11 p In FRENCH (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

A sequence is defined for automatically processing infrared images in order to detect and classify land targets. The nonuniformity of the background and the possible multiplicity of targets in these images require relatively complex processing which ends in the extraction of silhouettes. Methods for classifying the targets are considered. Transl. by A.R.H.

N81-20807# Philips Research Labs., Redhill (England).

REAL-TIME GREY-LEVEL HISTOGRAM MANIPULATION **c32**

L. H. Guildford *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 12 p refs (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

The problem of how best to match the characteristics of a video signal of high dynamic range to those of a display is addressed with emphasis on adequately depicting small, but often important contrast changes within regions of widely differing mean brightness levels. A solution to the problem is proposed, which involves the application of real-time histogram modification techniques to a selected sub-area (Keyhole) within the image, combined with overall 2-D edge enhancement. The ACE microprocessor which permits implementation of this algorithm in order to investigate the subjective effects of real-time operation is described and some pictorial results are presented. This operator gives promising results especially where the next result is a local adaptive contrast stretch. A.R.H.

N81-20808# Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).

TEAMWORK IN TARGET ACQUISITION **c53**

D. Dey, N. Ninz, and H. Mutschler (Fraunhofer-Inst. fuer Informations- und Datenverarbeitung, Karlsruhe) *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 16 p refs (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

The performance in target acquisition or real-time reconnaissance can be improved by a team of observers. Different possible team organizations and their characteristics are described. In experiments with forward looking TV-films shot from a low level flying aircraft, different pseudo-team algorithms of one to four operators are considered. The acquisition performances are measured with different criteria and a cost function is evaluated which weights the success and confidence of the acquisition and the time expense. Author

N81-20809# National Aerospace Lab., Amsterdam (Netherlands).

IMAGE PROCESSING TECHNIQUES USING SPLINE APPROXIMATION **c61**

W. C. Huisman and J. vanKasteel *In* AGARD Image and Sensor Process. for Target Acquisition and Recognition Nov. 1980 14 p refs (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

A two dimensional data compression method is described which is based on a least square image approximation with use of splines. This process is analyzed and in the frequency domain the feasibility of some candidate realizations of the real-time operating hardware is considered. The image reconstruction from the compressed data set consists of an off line computation of a modified compressed data set followed by a real-time replay interpolation process. In order to achieve a better image reconstruction, a flexible edge enhancement algorithm was developed. A.R.H.

N81-20810# Forschungsinstitut fuer Informationsverarbeitung, Karlsruhe (West Germany).

A FLEXIBLE IMAGE PROCESSING SYSTEM **c60**

Peter Gemmar, Hartmut Ischen, and Karl Luetjen *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 10 p ref (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

Design principles and implementation techniques to realize high performance capabilities in a multiprocessor system are described in terms of simultaneous processing, structural flexibility, and data input/output. The flexible image processing system (FLIP) which operates in conjunction with a host computer and can perform up to 64 MIPS (million instructions per second) can be considered as a multi-pipeline-processor comprising 16 individual processors and a high speed data input/output processor. Structural flexibility is achieved by individual processors which can be arranged by programming in nearly any manner to adapt the hardware to an optimal processing structure of the function to be processed. A special data exchange processor provides convenient and rapid access to image data especially for all kinds of homogeneously performed window operations. Experimental results show that FLIP reduces image processing times by factors between 10 to 100 compared with conventional techniques (e.g., using a 1 MIPS general purpose computer). A.R.H.

N81-20811# Etablissement Technique Central de l'Armement, Arcueil (France). Lab. de Traitement d'Images.

ASSISTANCE IN INTERPRETING SATELLITE MULTISPECTRAL IMAGERY [AIDE A L'INTERPRETATION EN IMAGERIE SATELLITE MULTISPECTRALE] **c35**

M. Rebuffet *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 13 p In FRENCH (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

Serval aspects of the help that image processing by computers can bring to the extraction of information contained in images obtained by satellite are examined. This extraction seeks to establish a cartography and define a planimetry. It helps photointerpreters which must be limited to the number of documents that they can consult and facilitates the man machine interface. The three aspects discussed are: (1) enhancement of a multispectral image and reduction of redundancy; (2) correction of the geometry of an image by relation to a reference; and (3) interactive extraction of information of a graphic nature.
Transl. by A.R.H.

N81-20812# British Aerospace Dynamics Group, Hatfield (England). Infra-Red Equipment Div.
RESEARCH INTO METHODS OF IMAGE PROCESSING FOR TARGET ENHANCEMENT AND DETECTION c74
D. B. Duke, A. J. Fryer, and P. A. Bird *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 17 p ref (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

Methods of enhancing targets with respect to their backgrounds for ease of detection and recognition are discussed with emphasis on sensitivity enhancement and spatial resolution enhancement. The use of these methods for improving image interpretability and automatic target detection are discussed.
A.R.H.

N81-20813# Norwegian Defence Research Establishment, Kjeller.
IMAGE ENHANCEMENT IN REAL TIME c61
H. Yndestad *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 5 p refs (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

An algorithm and a planned computer architecture for image enhancement in real time are presented. The algorithm reduces dynamic range and enhances contrast in an image by homomorphic filtering. The filter function is separable in column- and in line-direction, and the filter is implemented as a linear phase frequency sampling filter. Two dimensional filtering can then be achieved by filtering a picture first line by line and then column by column in a recursive filter. Dynamic range reduction and contrast enhancement are controlled by two parameters. The algorithm needs 32 arithmetic operations. The image processor is a set of processing elements, each having a specific task. One such task can be the described algorithm for homomorphic filtering. The processing element is built up by a microprocessor for local control, a bit slice processor for data transfer control and a specialized arithmetic unit for signal processing. Data transfer between processing elements is carried out in a high speed ring network.
Author

N81-20814# Forschungsinstitut fuer Informationsverarbeitung, Karlsruhe (West Germany).
SEMI-AUTOMATIC AND AUTOMATIC EXTRACTION OF OBJECTS FROM AERIAL IMAGES c35
W. Kestner and M. Sties *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 13 p refs (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

Different methods for the extraction of objects from aerial images are presented. Unlike other methods which process the complete image systematically, object guided methods were developed which are applied only to those parts of the image where objects or parts of objects have already been detected, i.e., where a continuation of an object is probable. Basic principles as well as details of the extraction methods are explained. The methods differ with respect to the local precision of the results, the applicability to different object types and the required image quality. Local operators are described which evaluate grey level diagrams in order to detect object continuations. The methods were implemented on a computer DEC PDP 11/70. Results are presented.
A.R.H.

N81-20815# Royal Signals and Radar Establishment, Malvern (England).
A DETECTION AND PROCESSING SCHEME FOR MOVING TARGET DETECTION USING A PASSIVE SENSOR c60
Charles M. Henderson *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 11 p (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

An adaptive spatial filter was implemented in digital hardware and a number of subsequent processing steps were developed including static clutter cancellation and tracking. The hardware is part of an experimental ground based infrared system for low level air surveillance. The spatial filter algorithm is based on using the intensities recorded in a small window to detect locally significant peaks. The effect of noise, quantization, and mismatch between channels is discussed. Variation in target subtense, target registration, and interchannel gaps affect detection probability and this was also explored by computer simulation. The filter produces multiple detections on a single peak and therefore an additional processing stage was devised to reduce multiple detections to single detections. Stationary alarms are removed by a process of static clutter cancellation and remaining alarms are handled by track forming using a microprocessor. Angular rate limits are applied to tracks and established tracks formed within rate limits are confirmed as moving targets.
E.D.K.

N81-20816# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Wesseling (West Germany). Inst. fuer Dynamik der Flugsysteme.
A TV-TRACKING SYSTEM BASED ON COMPUTER INTELLIGENCE c33
Gerhard Hirzinger and Klaus Landzettel *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 7 p refs (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

An operational system is described which tracks moving objects in an image and servoes a camera platform to continue tracking. The system uses a fast hardware contrast evaluation logic supplying contour coordinates to a supervisory control computer for further processing. Contrast evaluation is restricted to within a rectangular window, which is adapted to the object size automatically. The minicomputer being free from contour finding has enough time during one frame (20 msec) to process the contour data from the preceding frame. Essential criteria in treating problem situations are the changes in contour from the present frame to past frames after isolating the object motion from the superimposed camera motion. They are processed in a kind of heuristic truth tables. Improvements of the tracker are achieved merely by software refinements, that is by application of more elaborate algorithms. Originally the tracker was designed for ground to air tracking, meanwhile however ground to ground tracking was demonstrated for realistic situations too.
E.D.K.

N81-20817# Etablissement Technique Central de l'Armement, Arcueil (France).
NUMERICAL TARGET TRACKING [POURSUITE NUMERIQUE DE CIBLES] c61
Michel Girard *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 8 p In FRENCH (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

A method of logical correlation of images is applied to the tracking of targets on disturbed backgrounds. A target formed of several dozens of pixels can be characterized by points situated at angles to important density boundaries. The majority of these points are present in successive images and have the same vector of translation. They are then differentiated from the background. By this method, correlation is rapid and efficient, even for a disturbed background. It is also 'intelligent' because the evolution of a number of points often permits knowledge of the cause, and the algorithm best adapted for trying to avoid an uncoupling of the tracking can be chosen.
Transl. by A.R.H.

N81-20818# EMI Electronics Ltd., Feltham (England).
TARGET TRACKING USING AREA CORRELATION c74
R. M. B. Jackson *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 8 p (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

The tracking system described based on the area correlator technique can provide a stable and accurate track of targets for use in airborne systems in conjunction with FLIR or TV imagers.

It is a small size and can be built into standard format packages for installation in military aircraft. The main advantages of this technique are: (1) it can handle targets with a wide range of characteristics; (2) it can track background features to provide a ground reference; (3) it does not require that the edges of the target are within the tracking patches and it can handle targets which completely fill the field of view; (4) it can adapt automatically to magnification and target aspect changes; and (5) it provides highly tenacious tracking in low signal to noise conditions.
E.D.K.

N81-20819# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
A REAL-TIME VIDEO TRACKING SYSTEM BASED ON BAYES RULE **c64**
W. Weimer, W. Laier, and E. Keller *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 11 p refs (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

Essentially based on the distinction between two processes (target and scenery), tracking is broken down into three parts; signal acquisition and reduction, signal classification with respect to target and scenery, and determination of the target coordinates with the aid of the classified signals. It is shown that the Bayes' decision rule works optimally in a statistical sense. The target coordinates are determined by calculating the center of gravity using the probability of presence of the object pixels. In addition the target coordinates are filtered by means of a Kalman filter. This complete procedure is recursive and exhibits an adaptive, learning behavior. Similar algorithms were used in other applications and are known as unsupervised learning procedures.
E.D.K.

N81-20820# Forschungsinstitut fuer Informationsverarbeitung, Karlsruhe (West Germany).
TARGET TRACKING AND TARGET DETECTION IN TV- AND FLIR-IMAGERY **c74**
M. Bohner *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 17 p refs (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

Procedures for the detection of moving or stationary objects in single images and in image sequences and taken from a moving or stationary sensor are described. The objects are primarily located on the ground in their natural environment so that simple detection procedures cannot be applied. For those situations a tracking system was designed, simulated on a digital computer, and tested with an equipment for real time applications. The scale is determined separately and normalized by the location of object parts. The basic shortcomings of a correlation tracker system were eliminated in a system where in addition to the evaluation of the correlation function objects in the foreground or background are detected based on features like contrast, image differences, contour lines, shape, and relative speed of the objects.
E.D.K.

N81-20821# Elektronik-System G.m.b.H., Munich (West Germany).
TARGET IDENTIFICATION OF AIRCRAFT USING IR/TV-SENSOR-IMAGES **c74**
Dirk Meyer, Manfred Mueller, and Andreas Weimann *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 18 p refs (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

A procedure for noncooperative target identification of aircrafts by pattern recognition applied to TV/IR sensor images is presented. By a multi sensor tracking of high accuracy the position of an aircraft is well known. An imaging sensor with a narrow field of view is pointed to the aircraft if it is in range. The image is then processed for significant parameters. The contours are extracted by adequate methods of image processing and evaluated for geometric relations which are independent of the projection angle and specific for individual types of aircrafts. The application to typical aircraft contours shows that the ensemble of the extracted parameters can identify different types of aircraft with some significance. An algorithm based on momentum invariants is proposed. The algorithm was implemented and tested on a digital computer by means of simulated noisy images. Some examples of identification results are presented and discussed.
E.D.K.

N81-20822# Honeywell Systems and Research Center, Minneapolis, Minn.
AUTONOMOUS TARGET SCREENERS **c74**
R. K. Aggarwal, M. Geokezas, and D. E. Soland *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 14 p refs (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

The basic functions of an autonomous target screener are: segmentation, feature generation, classification (detection/recognition), and symbol generation. Image segmentation is the function by which the image is segmented in background and objects of interest. The image information within these objects of interest is processed to generate a set of features which characterize the targets of interest. The classification function utilizes statistical/syntactic classifier for detection (target vs. clutter decision) and recognition (truck, tank, APC, etc.). A symbol indicating the position and type of target is displayed on the monitor for cueing purposes.
E.D.K.

N81-20823# Army Night Vision Lab., Fort Belvoir, Va.
EVALUATION OF A REALTIME PROTOTYPE AUTOMATIC TARGET CUER **c74**
Terry L. Jones *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 7 p (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

The procedures used and problems encountered in the preliminary evaluation of a prototype automatic target cuer which operates on video imagery are presented. Performance measures are defined and their use and limitations described. An overview is given of the operation, training, and field test scenario used to test this target cuer. Results of cuer performance are presented as examples of cuer evaluation procedures.
E.D.K.

N81-20824# Rome Air Development Center, Griffiss AFB, N.Y.
DIGITAL IMAGE PROCESSING FOR GROUND TARGET DETECTION, IDENTIFICATION AND LOCATION **c61**
George R. Hughes *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 7 p (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

Technology intensive efforts are categorized under each of the exploitation elements: target detection, identification and precision location. Research and development in the area of target detection consists of exploratory and advanced development work units in automated target correlation, automatic change detection, and pipeline image processing for screening probable target areas. Target identification research and developments presented includes automatic techniques for pattern recognition as well as semiautomated techniques for aiding an analyst by correlating various sensor and intelligence inputs to permit target identification. Near real time precision target location techniques include techniques for locating imagery targets in a predefined precision photographic data base as well as techniques for performing location simultaneously with target identification.
E.D.K.

N81-20825# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Avionics Lab.
A SYSTEM LOOK AT REAL TIME PROCESSING FOR TARGET ACQUISITION AND CLASSIFICATION **c60**
Henry Lapp *In* AGARD Image and Sesor Data Process. for Target Acquisition and Recognition Nov. 1980 9 p refs (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

The target acquisition through classification tasks are analyzed and the machine processing and data screening techniques that are applicable are discussed. The data handling capabilities of an onboard operator and ground based image interpreter are compared. A philosophy of processing data to get information as early as possible in the data handling chain is examined in the context of ground exploitation and dissimenation needs. Examples of how the various real time sensors (screeners and

processors) could fit into this data handling scenario are discussed. E.D.K.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution.*

N81-20826 Connecticut Univ., Storrs.
BOUNDARY LAYER EFFECTS ON AN ACOUSTIC FIELD Ph.D. Thesis
Robert Thomas Nagel 1980 132 p
Avail: Univ. Microfilms Order No. 8106719

Boundary layer effects on an acoustic field in a unidirectional flow are studied. The acoustic pressure variation in the direction normal to that of the flow is governed in the boundary layer by a complicated, second order differential equation. The problem is reduced from a two point boundary value problem to a one point boundary value problem by transforming the equation into first order form. The result is easily integrated with standard numerical procedures, providing the effective admittance of the wall-boundary layer combination. The acoustic field in the uniform flow is then determined using the effective admittance. Further complications imposed by the boundary layer are thus eliminated. The technique is applied to both a flat plate of infinite extent and a circular duct. The calculated results include the reflection coefficient for the flat plate and the complex wavenumber in the axial direction for the circular duct. Sound propagation both upstream and downstream is considered. The boundary layer effects are usually more significant when sound propagates upstream. Dissert. Abstr.

N81-20827 Michigan Univ., Ann Arbor.
ULTRASONIC IMAGING WITH NARROW BEAM INSONIFICATION ACROSS A FLUID-METAL INTERFACE Ph.D. Thesis
Christiaan Jan Hagen VandenBroek 1980 194 p
Avail: Univ. Microfilms Order No. 8106239

The image of a point reflector in metal is obtained by synthetic ultrasonic arrays which utilize narrow beam transducers. A single scanning transducer moves through a number of discreet locations and is designed to generate a relatively narrow beam of sound (narrow beam insonification) within the test medium. Due to the narrow sound beam, it is necessary to tilt the transducer as it is moved laterally over the volume to be imaged. This technique allows the generation of images having high lateral resolution (better one wavelength) in thicker metal sections than otherwise possible. Fluid coupling between the transducer and metal test piece is assumed. The total response of a synthetic array to various point reflectors is given in the form of computer generated image plots. Good correlation between experiment and theory is obtained. It is shown that the attainable resolution is limited by noise that this noise is reduced through use of narrow beam insonification. Sources of noise and noise reduction through spatial averaging are discussed. Dissert. Abstr.

N81-20828 Pennsylvania State Univ., University Park.
QUANTITATIVE SCHLIEREN ANALYSIS OF ACOUSTIC INTERACTION WITH SUBMERGED PLATES Ph.D. Thesis
Roger Thomas Richards 1980 155 p
Avail: Univ. Microfilms Order No. 8105797

The transmission and radiation of sound from submerged plates are investigated by means of a quantitative schlieren method which produces accurate visual representations of sound fields. An improvement in the accuracy of quantized schlieren data is demonstrated, reducing the standard error to under one decibel. The further addition of stroboscopic techniques enabled the resolution of individual acoustic waves and permitted the differential between standing waves and progressive waves. The low frequency resolution of the classical schlieren system was also improved by nearly two orders of magnitude; sound waves as low as 27 kHz were easily visualized. These improvements in the quantitative schlieren system are demonstrated by a thorough study of transmission of sound through submerged metal plates over a frequency range extending from below to over a hundred times the classical coincidence frequency. Recent theoretical descriptions of the lowest order symmetrical Lamb wave are confirmed, and cancellation of modal pairs of Lamb waves with increasing frequency is observed. Dissert. Abstr.

N81-20829 Columbia Univ., New York.
IMPROVED ACOUSTIC APPROXIMATIONS FOR SUBMERGED SHELLS Ph.D. Thesis
Ranganathan Vasudevan 1980 71 p
Avail: Univ. Microfilms Order No. 8105109

Acoustic approximations are differential relations between fluid pressure and velocity used or the surface of a submerged structure to uncouple its motion from that of the fluid. Two recently proposed schemes, the Improved Doubly Asymptotic Approximation (DAA2) and the Inertial Damping Collocation Approximation (DCA), are capable of giving exact results for one component of response at one and two intermediate frequencies, respectively, in addition to predicting correct behavior at very low and very high frequencies, as the widely used Doubly Asymptotic Approximation (DAA) does, the choice of these fitting frequencies is optimized for spherical geometry and the predicted acoustic resistance and reactance curves are compared with each other, with exact solutions and with those obtained earlier using the DAA. The transient response of a spherical shell to a plane step shock wave is computed by means of the Fast Fourier Transform, using each of the approximations, and the results are compared with the exact solution. Dissert. Abstr.

N81-20830*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NASA PROGRESS IN AIRCRAFT NOISE PREDICTION
J. P. Raney, S. L. Padula, and W. E. Zorumski Mar. 1981 40 p refs
(NASA-TM-81915; L-14256) Avail: NTIS HC A03/MF A01 CSCL 20A

Langley Research Center efforts to develop a methodology for predicting the effective perceived noise level (EPNL) produced by jet-powered CTOL aircraft to an accuracy of + or - 1.5 dB are summarized with emphasis on the aircraft noise prediction program (ANOPP) which contains a complete set of prediction methods for CTOL aircraft including propulsion system noise sources, aerodynamic or airframe noise sources, forward speed effects, a layered atmospheric model with molecular absorption, ground impedance effects including excess ground attenuation, and a received noise contouring capability. The present state of ANOPP is described and its accuracy and applicability to the preliminary aircraft design process is assessed. Areas are indicated where further theoretical and experimental research on noise prediction are needed. Topics covered include the elements of the noise prediction problem which are incorporated in ANOPP, results of comparisons of ANOPP calculations with measured noise levels, and progress toward treating noise as a design constraint in aircraft system studies. A.R.H.

N81-20831*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH-FREQUENCY SOUND PROPAGATION IN A SPATIALLY VARYING MEAN FLOW
Y. C. Cho and E. J. Rice 1980 29 p refs Presented at the 100th Meeting of ASA, Los Angeles, 17-21 Nov. 1980
(NASA-TM-81751; E-797) Avail: NTIS HC A03/MF A01 CSCL 20A

An equation for acoustic ray paths in a spatially varying mean flow was examined to determine some of the characteristics of the flow gradient effects on sound propagation. In a potential flow, the acoustic rays are deflected in the direction of increasing mean flow, and the gradient of the mean flow speed is the dominant factor causing the ray deflection. In contrast, in a sheared mean flow, the vorticity is the dominant factor in deflection of the acoustic rays. Author

N81-20832# Naval Research Lab., Washington, D. C. Underwater Sound Reference Detachment.
A FORTRAN COMPUTER PROGRAM FOR CALCULATING THE PROPAGATION OF PLANE, CYLINDRICAL OR SPHERICAL FINITE AMPLITUDE WAVES Interim Report
D. H. Trivett and A. L. VanBuren 19 Feb. 1981 38 p refs
(RR0110842)

(AD-A095386; NRL-MR-4413) Avail: NTIS HC A03/MF A01 CSCL 20/1

A numerical solution to the generalized Burgers' radial wave equation has been developed; it allows one to calculate stepwise the harmonic content of a finite amplitude wave in the frequency domain for the case of plane, cylindrical, or spherical geometry. The finite amplitude wave may have any initial harmonic content with arbitrary phase, and the absorption coefficient of each harmonic is independently adjustable. Remaining in the frequency domain allows a much larger step than conventional algorithms, which alternate between the time and frequency domains. A listing of the computer program is included. GRA

N81-20833# National Bureau of Standards, Washington, D.C.
PSYCHOACOUSTIC EVALUATION OF TRANSMISSION LINE AUDIBLE NOISE: BUILDING ATTENUATION EFFECTS, METHODOLOGY COMPARISON, AND FIELD STUDY FEASIBILITY, VOLUME 1 Progress Report, 1 Jan. - 31 Dec. 1979
John A. Molino, Gerald A. Zerdy, and Susan G. Tremaine 1980 87 p refs
(Contract DE-AT01-77ET-29323)
(DOE/RA-29323/1) Avail: NTIS HC A05/MF A01

Research on evaluating the effects of corona noise from EHV and UHV power transmission lines on humans inside buildings is described. The corona noise from transmission lines was recorded, reproduced for human listeners in a simulated living room and the human response to the noise was measured in the room. It was found that: despite its low sound level, corona noise is somewhat more adversive to people than might be expected on the basis of physical measurements of the sound; corona noise may not be a problem inside a well-constructed and insulated house with the windows closed; high frequency hissing and crackling noises are more aversive than low-frequency humming and buzzing noise components; and more data is needed to evaluate the human response to corona sounds. DOE

N81-20834# Battelle Pacific Northwest Labs., Richland, Wash.
ACOUSTIC EMISSION. FLAW RELATIONSHIP FOR IN-SERVICE MONITORING OF NUCLEAR PRESSURE VESSELS
P. H. Hutton and R. J. Kurtz 1980 8 p Presented at the ACRS Metal Component Subcomm. for Reactor Safety Meeting, Washington, D.C., 17 Jun. 1980
(Contract DE-AC06-76RL-01830)
(PNL-SA-8691; CONF-8006142-1) HC A02/MF A01

Acoustic emission (AE) testing has the potential of being a valuable NDI method with capability for continuous monitoring, high sensitivity, and remote flaw location. Tests of the method were carried out on ASTM A533 Grade B, Class 1 steel. Crack growth AE signals could be recognized. An AE/fracture mehcanics relation was developed for flaw interpretation. Two intermediate vessel tests at ORNL under the HSST program were analyzed. A simulated reactor vessel test and installation of an AE sensing system on a reactor are planned. DOE

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N81-20835# Columbia Univ., New York.
ULTRAVIOLET PHOTODISSOCIATION OF MOLECULAR BEAMS Final Report, 1 Oct. 1977 - 30 Sep. 1980
R. Bersohn 15 Dec. 1980 6 p
(Grant DAAG29-78-G-0004)
(AD-A095472; ARO-15014.3-C) Avail: NTIS HC A02/MF A01 CSCL 07/5

The Ar-F laser (193 nm) was used to photodissociate molecular beams of SO2, CS2, aryl halides, phenyl cyanide and isocyanide, nitroalkenes and nitrobenzene, and H2O2. The translational energy distributions of the fragments were measured. In addition, the internal energy distributions of CS (from CS2) and OH fragments from H2O2 were measured. The excess of photon energy over bond energy is released primarily as vibration for SO2 and primarily as translation for H2O2. For CS2 comparable amounts of energy appear in translation and vibration; 80% of the S atoms appear in the 1(D) state. Both phenylcyanide, C6H5CN and phenylisocyanide, C6H5NC gave CN and C6H5 fragments. In spite of the greater energy available, C6H5NC yielded slower CN fragments. The iodobenzene fragmentation occurred by two processes, one from the initially excited state which gave fast fragments and the other from a lower energy state which gave slower fragments and, of course, more internal energy. GRA

N81-20836# New York Univ., N. Y. Dept. of Chemistry.
NON-ADIABATIC CAPTURE OF MOBILE ELECTRONS IN AQUEOUS SOLUTION
Kathrin vonBurg and Paul Delahay 1981 21 p refs Submitted for publication
(Contract N00014-75-C-0397)
(AD-A095524; TR-14) Avail: NTIS HC A02/MF A01 CSCL 07/4

Experimental evidence and theoretical arguments are presented for 11 effective and eight ineffective cations for non-adiabatic capture of mobile electrons in the photoionization (equal to or less than 10.5 eV) of anions (Cl(-), Cl04(-), SO4(--) in aqueous solution. This effect lowers yields and increases threshold energies for photoelectron emission by anions in the gas phase. GRA

N81-20837# Oregon Univ., Eugene. Dept. of Physics.
ATOMIC INNER-SHELL PROCESSES Final Report, 1 Nov. 1977 - 31 Oct. 1980
Bernd Crasemann and Mau Hsiung Chen 15 Jan. 1981 9 p refs
(Grant DAAG29-78-G-0010)
(AD-A095415; ARO-15208.14-P) Avail: NTIS HC A02/MF A01 CSCL 20/8

X-ray and Auger transition probabilities were calculated for atoms that have been singly and multiply ionized in inner shells. The effects of relativity and configuration interaction on these rates were studied, and lifetimes of atomic inner-shell holes were computed. Synchrotron radiation was employed for precision measurements of atomic level energies, for the study of inelastic scattering, and for the investigation of sub-threshold excitation of atomic hole states. GRA

N81-20838# Louisiana State Univ. and A&M Coll., Baton Rouge. Dept. of Physics and Astronomy.
ATOMIC COLLISION THEORY Final Report
Ronald J. W. Henry Jan. 1981 8 p refs
(Contract N00014-76-C-0041)
(AD-A095284) Avail: NTIS HC A02/MF A01 CSCL 20/8

The work of the LSU theoretical atomic physics group under this contract was directed originally toward the computation of rotational-vibrational cross sections for electron impact excitation of H2 and toward the development and improvement of calculational techniques. This theme remained dominant but variations and extensions to diverse topics were developed such as a study of autodetaching states of negative ions or the effect of strong magnetic fields on atoms. In addition, attention was directed towards the calculation of cross sections for electron excitation of oxygen and copper, atoms important in the upper atmosphere of the Earth and in laser development, respectively. The major thrust of work involved calculations on rotational-vibrational excitation of molecules D2, H2, and HCL. GRA

N81-20839# City Univ. of New York, N. Y. Dept. of Physics.
THEORETICAL STUDIES OF ATOM SURFACE INTERACTIONS Final Report, 1 Jul. 1975 - 31 Dec. 1980
Narkis Tzoar Feb. 1981 66 p refs
(Contract N00014-75-C-0949)
(AD-A095341; TR-5) Avail: NTIS HC A04/MF A01 CSCL 20/12

A first principles kinetic theory was developed, applicable to angular and energy dependent emission in Electron Stimulated Desorption. Expressions for the ionic and neutral atoms ESD cross section were formulated and applied in a model calculations of o+ emission from W(100) and W(111). Strong focusing of the outgoing ions was found. Off-axis spot groups were simulated and compared with experimental results. GRA

N81-20840# Washington Univ., Seattle.
CORRELATION OF ALIGNED ANGULAR MOMENTUM WITH SCATTERING ANGLE AND ENERGY LOSS IN DEEPLY INELASTIC COLLISIONS
A. Lazzarini, V. Metag, A. G. Seamster, R. Vandenbosch, and R. Loveman 1980 12 p refs
(Contract DE-AC06-76ER-01388)
(DOE/ER-01388/464) Avail: NTIS HC A02/MF A01

(GAMMA)-ray in-plane to out-of-plane anisotropy and multiplicity are determined for the (100)Mo + (165)Ho reaction at E/sub cm/ = 450 MeV. The measurements are made as functions of Q-value and theta/sub cm/ for the coincident quasi or deeply inelastically scattered ions. Strong correlations of the aligned angular momentum with both energy loss and scattering angle are observed. DOE

N81-20841# Oak Ridge National Lab., Tenn.
STUDY OF THE IONIZATION OF C, N, O, Nr, Kr AND Xe POSITIVE IONS BY ELECTRON IMPACT
E. D. Donets and V. P. Ovsyannikov 1980 15 p refs Transl. into ENGLISH from Russian article, Dubna, USSR, 1980
(ORNL-tr-4702) Avail: NTIS HC A02/MF A01

A description of the methods used for measuring and the results for all positive ions of C, N, O, Ne, and Ar, excluding Ne(1+) and Ar(1+ 2+), as well as qualitative data for Kr and Xe, are presented. A comparison is presented with theoretical values in those cases where they are available. DOE

N81-20842# Rockefeller Univ., New York.
STUDY OF DIRECT SINGLE PHOTONS AND CORRELATED PARTICLES IN PROTON-PROTON COLLISIONS AT SQUARE ROOTS = 62-4 GeV (CCOR COLLABORATION)
H. J. Besch, L. Camilleri, C. delPapa, L. DiLella, C. B. Newman, B. G. Pope, S. H. Pordes, A. M. Smith, K. K. Young, B. J. Blumenfeld et al 1980 4 p refs Presented at the 20th Intern. Conf. on High Energy Phys., Madison, Wisc., 17 Jul. 1980 Prepared in cooperation with European Organization for Nuclear Research, Columbia Univ., and Oxford Univ.
(Contract DE-AC02-76ER-02232)
(DOE/ER-02232/94; CONF-800724-59) Avail: NTIS HC A02/MF A01

Invariant cross sections for direct single photon production were measured with thresholds of 3, 5, 7, and 9 GeV/c in p/sub T/. The fraction gamma/all of single photon events in the data sample is plotted. The +/- charge ratio in the hemisphere opposite the trigger was determined for single gamma and pi type events. DOE

N81-20843# Sandia Labs., Albuquerque, N. Mex. Theoretical Div.
COLLOCATION METHOD FOR THE SOLUTION OF THE NEUTRON TRANSPORT EQUATION WITH BOTH SYMMETRIC AND ASYMMETRIC SCATTERING
J. E. Morel Jan. 1981 189 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-1446) Avail: NTIS HC A09/MF A01

A collocation method is developed for the solution of the one-dimensional neutron transport equation in slab geometry with both symmetric and polarly asymmetric scattering. For the symmetric scattering case, it is found that the collocation method offers a combination of some of the best characteristics of the finite-element and discrete-ordinates methods. For the asymmetric scattering case, it is found that the computational cost of cross-section data processing under the collocation approach can be significantly less than that associated with the discrete-ordinates approach. A general diffusion equation treating both symmetric and asymmetric scattering is developed and used in a synthetic acceleration algorithm to accelerate the iterative convergence of collocation solutions. It is shown that a certain type of asymmetric scattering can radically alter the asymptotic behavior of the transport solution and is mathematically equivalent within the diffusion approximation to particle transport under the influence of an electric field. DOE

N81-20844# Sandia Labs., Albuquerque, N. Mex. Plasma Theory Div.
ONE-DIMENSIONAL SPACE-CHARGE NEUTRALIZATION OF THE ION BEAMS
J. W. Poukey Nov. 1980 39 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-2545) Avail: NTIS HC A03/MF A01

Particle simulation methods and analytic theory are used to study the equilibrium, stability, and nonlinear behavior of the one-dimensional longitudinal space-charge neutralization problem. For both co-moving and space-charge-limited electrons, the potentials and phase-space behavior are computed, and the code results are shown to agree with analytic equilibria and stability results. The effect of ion-beam risetime on the transverse neutralization problem is studied. DOE

N81-20845# Oregon Univ., Eugene. Dept. of Physics.
QUARK AND GLUON DECAY FUNCTIONS IN QCD AND RECOMBINATION MODEL
Van Chang and Rudolph C. Hwa Apr. 1980 27 p refs
(Contracts DE-AT06-76ER-70004; EY-76-S-06-2230)
(DOE/ER-70004/266; RLO-2230-T4-266) Avail: NTIS HC A03/MF A01

Inclusive longitudinal momentum distributions of pions in jets initiated by quarks and gluons were determined in perturbative QCD and recombination model. The quark and antiquark joint distributions in jets are first calculated in the leading order approximation at high Q squared. Gluons in the q anti q pairs with definite quantum numbers then recombine to form pions. The recombination function for the process is well determined in the valon model. No adjustable parameters were involved in these calculations, and no data at low Q squared were used as phenomenological input. DOE

N81-20846# Mount Holyoke Coll., South Hadley, Mass.
WEAK DECAYS AND CHARM SEARCHES Annual Progress Report, 1 Mar. 1980 - 28 Feb. 1981
H. W. Nicholson Oct. 1980 10 p refs
(Contract DE-AC02-78ER-04831)
(COO-4831-3) Avail: NTIS HC A02/MF A01

Results of statistically precise measurements of K(-)p and anti pp scattering cross sections are reported. Progress was made in solving technical problems in measuring the asymmetry parameter in the radiative decay (SIGMA) (+) (ARROW) p (GAMMA). An experiment was designed to search for the charmed eta and eta prime mesons. DOE

N81-20847# Los Alamos Scientific Lab., N. Mex.
SINGLE PHOTON EXCIMER LASER PHOTODISSOCIATION OF HIGHLY VIBRATIONALLY EXCITED POLYATOMIC MOLECULES
J. J. Tiee, F. B. Wampler, and W. W. Rice 1980 14 p refs Presented at the 3rd Intern. Conf. on Lasers and Appl., New Orleans, 15 Dec. 1980
(Contract W-7405-eng-36)
(LA-UR-80-3459; CONF-801201-4) Avail: NTIS HC A02/MF A01

The IR + UV photodissociation of SF6 was performed using C02 and ArF lasers. The two color photolysis enhances the photodissociation process over ArF irradiation alone and is found to preserve the initial isotopic of the ir excitation process. DOE

N81-20848# Los Alamos Scientific Lab., N. Mex. Theoretical Div.
PERTURBATION THEORY APPROACH TO THE GROUND STATE ENERGY IN AN INFINITE FERMION SYSTEM
George A. Baker, Jr. 1981 7 p refs Presented at the 2nd Intern. Conf. on Recent Progr. in Many-Body Theories, Mexico City, 12-16 Jan. 1981
(Contract W-7405-eng-36)
(LA-UR-80-3658; CONF-810107-1) Avail: NTIS HC A02/MF A01

The progress of the Rayleigh-Schroedinger perturbation theory approach to the computations of the ground state energy in an infinite Fermion system is reviewed. DOE

N81-20849# Los Alamos Scientific Lab., N. Mex.
TESTS OF DYNAMICAL SUPERSYMMETRIES VIA CHARGED PARTICLE TRANSFER REACTIONS
J. A. Cizewski 1980 7 p refs Presented at the Intern. Conf. on Interacting Bose-Fermi Systems in Nuclei, Eric (Italy), 12-19 Jun. 1980

(Contract W-7405-eng-36)
(LA-UR-80-3476; CONF-8006127-4) Avail: NTIS HC A02/MF A01

The (t,P) and (t/sup (ARROW)/,(ALPHA) reactions on enriched (191) (193)Ir targets were investigated: The resultant spectroscopic strengths are compared and contrasted with the expectations of the dynamical supersymmetry scheme proposed for the Pt-Ir region. DOE

N81-20850# Harvard Coll. Observatory, Cambridge, Mass.
THEORETICAL STUDIES OF HIGHLY IONIZED SPECIES Progress Report, 1 Mar. 1980 - 28 Feb. 1981
A. Dalgarno and G. A. Victor Oct. 1980 5 p
(Contract DE-AS02-76ET-02887)
(DOE/ER-02887/2) Avail: NTIS HC A02/MF A01

The calculations of the charge transfer recombination and ionization rate coefficients for a wide range of ionic systems in collision with hydrogen and helium at thermal energies were completed. For the carbon ions in hydrogen, the calculations were extended to energies of 100 ev. The importance of the processes in ionized plasmas was demonstrated by studies of the solar corona and of shock waves. Preliminary results were obtained on cross sections for the excitation of fine structure transitions by proton impacts. The mechanisms leading to the photodissociation of alkali metal dimers were identified and quantitative predictions were made for Li2. Calculations using the model potential method of properties of the Cu and Zn sequences were brought to a conclusion. Applications of the relativistic random phase approximation were made to the calculation of photoionization cross sections of magnesium-like and zinc-like ions and of oscillator strengths of mercury. DOE

N81-20851# California Univ., Livermore. Lawrence Livermore Lab.
SAUSAGE MODE STABILITY BOUNDARIES: ENUMERATION AND VERIFICATION
Frank W. Chambers 2 Dec. 1980 19 p refs
(Contract W-7405-eng-48)
(UCID-18879) Avail: NTIS HC A02/MF A01

An axially symmetric sausage mode instability was observed using particle simulation codes to propagate beams with a high degree of current neutralization. The stability boundaries in terms of the magnitude and location of the return current are delineated for beams with square, Gaussian, and Bennett radial current profiles using the theoretical analysis of others. For the case in which the return current is held fixed as the beam propagates, a detailed comparison is made between the theoretical predictions and the results of the RINGFAST single disk particle simulation code. Agreement between theory and code results is good although the code results show a slightly larger than predicted unstable region. DOE

N81-20852# California Univ., Livermore. Lawrence Livermore Lab.
SCORING METHODS FOR IMPLICIT MONTE CARLO RADIATION TRANSPORT
A. L. Edwards Jan. 1981 24 p ref
(Contract W-7405-eng-48)
(UCID-18858) Avail: NTIS HC A02/MF A01

Analytical and numerical tests were made of a number of possible methods for scoring the energy exchange between radiation and matter in implicit Monte Carlo (IMC) radiation transport. The interactions considered were effective absorption, elastic scattering, and Compton scattering. The scoring methods tested were limited to simple combinations of analog, linear expected value, and exponential expected value scoring. Only two scoring methods were found that produced the same results as a pure analog method. These are a combination of exponential expected value absorption and deposition and analog Compton scattering of the particle, with either linear expected value Compton deposition or analog Compton deposition. In both methods, the collision distance is based on the total scattering cross section. DOE

N81-20853# European Organization for Nuclear Research, Geneva (Switzerland).
MEASUREMENT OF THE TRANSVERSE MOMENTA OF PARTONS AND OF JET FRAGMENTATION AS A FUNCTION OF SQUARE ROOTS IN P-P COLLISIONS: CCOR COLLABORATION
H. J. Besch, L. Camilleri, C. delPapa, L. DiLella, C. B. Newman, B. G. Pope, S. H. Pordes, A. M. Smith, K. K. Young, and B. J. Blumenfeld 1980 7 p refs Presented at the 20th Intern. Conf. on High Energy Phys., Madison, Wisc., 17 Jul. 1980 Prepared in cooperation with Columbia Univ., Oxford Univ., and Rockefeller Univ.
(Contract DE-AC02-76ER-02232)
(DOE/ER-02232/92; CONF-800724-58-Summ) Avail: NTIS HC A02/MF A01

A large solid angle apparatus consisting of a superconducting solenoid magnet, cylindrical drift chambers, and two arrays of lead glass counters was used to examine particles associated with a high transverse momentum trigger in p-p collisions. The trigger was given by energy deposition in lead glass arrays centered in 90 degrees. The trigger transverse momentum range covered was 3 less than p/sub Ttrig/ less than 11 GeV/c. Results are given for p/sub out/ for both individual charged particles and the sum of charged particle moments in the hemisphere opposite to the trigger. Mean values are then deduced for the parton transverse momentum, k/sub T/, and for the jet fragmentation momentum, j/sub T/. Results of a jet analysis are also presented. DOE

N81-20854# Texas A&M Univ., College Station.
HOT ATOM REACTIONS INVOLVING MULTIVALENT AND UNIVALENT SPECIES Progress Report, Feb. 1980 - Jan. 1981
Y. N. Tang 1981 65 p refs
(Contract DE-AS05-76ER-03898)
(DOE/ER-03898/52) Avail: NTIS HC A04/MF A01

Recoil (31)Si reactions were investigated. The most significant discovery is that monomeric (31)SiF2 adds to two molecules of C2H4 to give 1,1-difluorosilacyclopentane as a final product. When radical scavengers were added, the yield of this product was not altered. When 1,3-butadiene was added to the above recoil (31)Si system to compete with C2H4 for the available (31)SiF2, a nearly complementary relationship was found between 1,1-difluorosilacyclopent 3 ene (31)Si, the butadiene product, and 1,1 difluorosilacyclopentane (31)Si. Quantitatively, it was deduced that butadiene is about ten times more reactive than C2H4 for the trapping of (31)SiF2. When Ne was added as a moderator to the 5:1 C2H4:butadiene competition system, the two product ratio shifts from 1:2 in favor of butadiene to 10:1 in favor of C2H4. This indicates that it is the lower energy (31)SiF2 species which is captured by C2H4, while it is favorable for the more energetic (31)SiF2 to be captured by butadiene. In the systems reacting recoil (31)Si atoms with C2H4 in the presence of PF3, four unidentified products with yields less than that of 1,1 difluorosilacyclopentane were also observed. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N81-20855# Brookhaven National Lab., Upton, N. Y.
FASTBUS SYSTEM USED IN A HIGH ENERGY EXPERIMENT
L. B. Leipuner, J. Fuhrmann, R. Larsen, D. Makowiecki, W. Morse, T. Rufolf, W. Sims, S. Blatt (Yale Univ., New Haven, Conn.), M. Campbell (Yale Univ., New Haven, Conn.), H. Kasha (Yale Univ., New Haven, Conn.) et al 1980 11 p Presented at the IEEE Nucl. Sci. Symp., Orlando, Fla., 5 Nov. 1980
(Contract DE-AC02-76CH-00016)
(BNL-28613; CONF-801103-28) Avail: NTIS HC A02/MF A01

Experiment No. 735, now being executed at the A.G.S. is implemented in FASTBUS, a data acquisition system designed to operate and gather data from high energy physics experiments at sub-microsecond speeds. This 32 bit bus system is capable

of operating at near-gigabit rates. The bus can be segmented with each segment operating independently when not communicating with each other. The system is based upon a very fast integrated circuit family, emitter coupled logic or ECL. DOE

N81-20856# Stanford Linear Accelerator Center, Calif.
PROCEEDINGS OF THE BEAM-BEAM INTERACTION SEMINAR
Oct. 1980 351 p refs Conf. held at Stanford, Calif., 22-23 May 1980
(Contract DE-AC03-76SF-00515)
(SLAC-PUB-2624; CONF-8005102) Avail: NTIS HC A16/MF A01

The beam-beam interaction continues to be a performance limiting effect in colliding beam systems. Electron-positron collisions are typically more than a factor of five lower in luminosity than expectations from beam design and with present understanding, extrapolations to future systems are not satisfactory. Prediction and optimized design are even more uncertain for proton-proton and proton-antiproton future systems with the ISR at CERN being the sole precedent. The health of the high energy physics program in the next decades depends to a significant extent on the ability to unravel the mechanisms of this phenomenon and to control them. There have been a variety of studies, including a plasma model of e(+)e(-) collisions, models emphasizing the effects of noise and a model involving a diffusion-damping equilibrium. Various nonlinear analyses of the beam-beam systems were performed and an entirely new form of beam-beam configuration is proposed and studied - the very strong single pass collider. Written versions of 17 seminar papers are presented without editing. DOE

N81-20857# California Univ., Berkeley. Lawrence Berkeley Lab. Earth Sciences Div.
RADIOACTIVE WASTE STORAGE IN MINED CAVERNS IN CRYSTALLINE ROCK: RESULTS OF FIELD INVESTIGATIONS AT STRIPA, SWEDEN
P. A. Witherspoon Oct. 1980 64 p refs Presented at the 75th Anniv. of the Ill. State Geol. Survey Symp., Urbana, Ill., 9-10 Oct. 1980
(Contract W-7405-eng-48)
(LBL-11651; CONF-8010132-1) Avail: NTIS HC A04/MF A01

The most practicable method of isolating nuclear wastes from the biosphere is by deep burial in suitable geologic formations. To assess the effectiveness of geologic isolation, it is necessary to develop the capability of predicting the response of a rock mass to thermal pulses. Access to a granitic rock mass adjacent to a defunct iron ore mine at Stripa, Sweden, at a depth of about 350 M below surface provided a unique opportunity to conduct a comprehensive suite of hydrological and thermo-mechanical experiments. The results of these field tests showed the importance of geologic structure and the functional dependence of the thermo-mechanical properties on temperature in developing a valid predictive model. The results also demonstrated the vital importance of carrying out large-scale investigations in a field test facility. DOE

N81-20858# Battelle Pacific Northwest Labs., Richland, Wash.
RADIATION EFFECTS IN CRYSTALLINE HIGH-LEVEL NUCLEAR WASTE SOLIDS
W. J. Weber, J. W. Wald, and W. J. Gray Oct. 1980 9 p refs Presented at the 3rd Ann. Meeting of the Mater. Res. Soc., Boston, 16-21 Nov. 1980
(Contract DE-AC06-76RL-01830)
(PNL-SA-8732; CONF-801124-33) Avail: NTIS HC A02/MF A01

Glass, cement, and crystalline-ceramic waste forms are being considered as potential solid forms for incorporation of nuclear wastes. The general radiation damage problem is defined and experimental results from studies of the effects of alpha decay, alpha bombardment, and transmutations on crystalline waste forms, related single-phase compounds and some glass waste forms are summarized. The results lead to the following conclusions: both alpha-recoil damage in actinide host phases and alpha damage to all other phases must be considered since significant structural changes may occur from either source; the ingrowth of damage follows exponential behavior for both alpha-recoil damage and alpha damage, leading to saturation effects in most materials; and preliminary results show no significant effect of transmutations on waste form stability. DOE

N81-20859# Los Alamos Scientific Lab., N. Mex.
ACCELERATOR DEVELOPMENT FOR HEAVY ION FUSION
W. L. Talbert, Jr. and G. A. Sawyer 1980 15 p refs Presented at 6th Conf. on the Appl. of Accelerators in Res. and Ind., Denton, Tex., 3-5 Nov. 1980
(Contract W-7405-eng-36)
(LA-UR-80-2822; CONF-801111-6) Avail: NTIS HC A02/MF A01

Accelerator technology development is presented for heavy ion drivers used in inertial confinement fusion. The program includes construction of low velocity test bed accelerator facilities, development of analytical and experimental techniques to characterize ion beam behavior, and the study of ion beam energy deposition. DOE

N81-20860# Los Alamos Scientific Lab., N. Mex.
CONCEPTS AND LIMITATIONS OF MACROPARTICLE ACCELERATORS USING TRAVELING MAGNETIC WAVES
Stefan L. Wipf 1980 22 p refs Presented at the Electromagnetic Guns and Launchers Conf., San Diego, Calif., 4-6 Nov. 1980
(Contract W-7405-eng-36)
(LA-UR-80-3507; CONF-801138-7) Avail: NTIS HC A02/MF A01

An accelerator using a travelling magnetic wave acting on magnetized projectiles is discussed. Although superconductors have a high potential as projectile material, their low critical temperature makes them unsuitable. Among ferromagnetic materials dysprosium seems to be superior. For stable suspension and guidance a high conductivity, guide sheet is necessary. Magnetic field gradients of 10(9) A/m(2) travelling at 10(6) m/s should be achievable using present state of the art components; resulting accelerations are greater than or equal to 500 km/s(2). A linear accelerator for final speeds of 50 km/s needs a length of 2.5 km. Guidance forces sufficient to produce acceleration of 2 x 10(6) m/s(2) allow circular accelerators of reasonable size to achieve hypervelocities for small (50 to 100 mg) projectiles. An accelerator of 170 m diameter would surpass the best results from light gas gums. Travelling waves suitable for accelerations of the order of 10(4) m/s(2) can be produced without switching, by means of flux displacing rotors, easily adapted to circular accelerators. DOE

N81-20861# Brookhaven National Lab., Upton, N. Y.
SEMICONDUCTOR DEVICES AS TRACK DETECTORS IN HIGH ENERGY COLLIDING BEAMS EXPERIMENTS
T. Ludlam 1980 15 p refs Presented at the IEEE Nucl. Sci. Symp., Orlando, Fla., 5 Nov. 1980
(Contract DE-AC02-76CH-00016)
(BNL-28850; CONF-800103-47) Avail: NTIS HC A02/MF A01

The full exploitation of machines like ISABELLE calls for detector capabilities beyond what can be expected from refinements of the conventional approaches to particle detection in high energy physics experiments. Semiconductor device technology offers the possibility of position sensing detectors having resolution elements with dimensions of the order of 10 microns or smaller. Such a detector could offer enormous advantages in the design of experiments. Some of the possibilities and some of the problems are discussed. DOE

74 OPTICS

Includes light phenomena.

N81-20862 Arizona Univ., Tucson.
NONLINEAR OPTICAL PHASE CONJUGATION BY 3-WAVE AND 4-WAVE MIXING Ph.D. Thesis
Akira Tomita 1980 105 p
Avail: Univ. Microfilms Order No. 8105307

Three different schemes in which phase conjugation was demonstrated was evaluated by direct inspection of the conjugate wavefront. Three-wave mixing using a phase matched crystal, in

which a signal wave is mixed with a pump wave at doubled frequency generates a conjugate wave in a transmission geometry. This technique suffers phase matching restrictions which cause a distortion that is predominantly in the conjugate wave amplitude. The second scheme utilizes the saturation phenomena of a two level atom system (Nd:YAG laser) as the nonlinear mechanism. A special four wave mixing geometry, in which a signal wave interacts with two counterpropagating pump waves in the nonlinear medium, generates a conjugate wave in a reflection geometry. This scheme requires no additional nonlinear medium, has potential applications to multiline and cw lasers and has no phase matching restrictions. Nonlinearity due to a free carrier plasma generated inside the semiconductor by interband transitions was demonstrated using silicon at 1.06 micron in the four wave mixing geometry. Self defusing phemonena were investigated in this scheme using interferometric techniques. The high efficiency of the conjugation process makes this scheme attractive for real applications. Dissert. Abstr.

N81-20863*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex.

ADVANCED METHODS FOR PREPARATION AND CHARACTERIZATION OF INFRARED DETECTOR MATERIALS Final Report, 5 Dec. 1978 - 5 Jul. 1980

S. L. Lehoczky, F. R. Szofran, and B. G. Martin 5 Jul. 1980 159 p refs

(Contract NAS8-33107)

(NASA-CR-161598; MDC-Q0717) Avail: NTIS HC A08/MF A01 CSCL 20F

Mercury cadmium telluride crystals were prepared by the Bridgman method with a wide range of crystal growth rates and temperature gradients adequate to prevent constitutional supercooling under diffusion-limited, steady state, growth conditions. The longitudinal compositional gradients for different growth conditions and alloy compositions were calculated and compared with experimental data to develop a quantitative model of the crystal growth kinetics for the Hg(i-x)CdxTe alloys, and measurements were performed to ascertain the effect of growth conditions on radial compositional gradients. The pseudobinary HgTe-CdTe constitutional phase diagram was determined by precision differential thermal analysis measurements and used to calculate the segregation coefficient of Cd as a function of x and interface temperature. Computer algorithms specific to Hg(1-x)CdxTe were developed for calculations of the charge carrier concentrations, charge carrier mobilities, Hall coefficient, optical absorptance, and Fermi energy as functions of x, temperature, ionized donor and acceptor concentrations, and neutral defect concentrations. A.R.H.

N81-20864*# Space Optics Research Labs., Inc., Chelmsford, Mass.

SCHWARZSCHILD CAMERA Final Report

1980 14 p

(Contract NAS5-22961)

(NASA-CR-160061) Avail: NTIS HC A02/MF A01 CSCL 20F

The fabrication procedures for the primary and secondary mirrors for a Schwarzschild camera are summarized. The achieved wave front for the telescope was 1/2 wave at .63 microns. Interferograms of the two mirrors as a system are given and the mounting procedures are outlined. M.G.

N81-20865*# Itek Corp., Lexington, Mass.

ORBITER CAMERA PAYLOAD SYSTEM Final Report

19 Dec. 1980 68 p

(Contract NAS9-15671)

(NASA-CR-160937; ITEK-9555-80-939) Avail: NTIS HC A04/MF A01 CSCL 20F

Components for an orbiting camera payload system (OCPS) include the large format camera (LFC), a gas supply assembly, and ground test, handling, and calibration hardware. The LFC, a high resolution large format photogrammetric camera for use in the cargo bay of the space transport system, is also adaptable to use on an RB-57 aircraft or on a free flyer satellite. Carrying 4000 feet of film, the LFC is usable over the visible to near IR, at V/h rates of from 11 to 41 milliradians per second, overlap of 10, 60, 70 or 80 percent and exposure times of from 4 to 32 milliseconds. With a 12 inch focal length it produces a 9 by 18 inch format (long dimension in line of flight) with full format low contrast resolution of 88 lines per millimeter (AWAR), full format distortion of less than 14 microns and a complement of 45 Reseau marks and 12 fiducial marks. Weight of the OCPS as supplied, fully loaded is 944 pounds and power dissipation is 273 watts average when in operation, 95 watts in standby. The LFC contains an internal exposure sensor, or will respond to external command. It is able to photograph starfields for inflight calibration upon command. A.R.H.

N81-20866*# National Aeronautics and Space Administration, Washington, D. C.

GIRL: GERMAN INFRARED LABORATORY. TELESCOPE STUDY, PHASE B Final Report

R. Schlegelmilch and Carl Zeiss Jan. 1981 175 p Transl. into ENGLISH of "GIRL - German Infrared Laboratory; Schlussberict der Teleskopstudie Phase B" Rept. MBB R-3600/0170-R Ottobrun, West Germany, 1980 197 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by MBB, Ottobrunn, West Germany

(Contract NASw-3199)

(NASA-TM-75911) Avail: NTIS HC A08/MF A01 CSCL 20F

The construction and mounting of mirrors for an infrared telescope are described. Tests conducted to determine the thermal and stress characteristics of various types of mounting for main and collection mirrors are also discussed. A.R.H.

N81-20867*# National Aeronautics and Space Administration, Washington, D. C.

SEMICONDUCTOR DEVICES FOR OPTICAL COMMUNICATIONS IN 1 MICRON BAND OF WAVELENGTH

Y. Suematsu and K. Iga Nov. 1980 34 p refs Transl. into ENGLISH from J. Inst. Elec. Commun. Eng. Jap. (Japan), v. 63, no. 1, Jan. 1980 p 27-37 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-75869) Avail: NTIS HC A03/MF A01 CSCL 20F

Crystal growth and the characteristics of semiconductor lasers and diodes for the long wavelength band used in optical communications are examined. It is concluded that to utilize the advantages of this band, it is necessary to have a large scale multiple wavelength communication, along with optical cumulative circuits and optical exchangers. A.R.H.

N81-20868*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

THE PASSIVE OPTICAL SAMPLE ASSEMBLY (POSA) ON STS-1

Roger C. Linton Mar. 1981 17 p

(NASA-TM-82407) Avail: NTIS HC A02/MF A01 CSCL 20F

The passive optical sample assembly (POSA) hardware, scheduled for the flight on orbital flight test 1 is described. The function of the instrument is aid in the assessment contamination hazards to sensitive payloads in the shuttle cargo bay. It consists of an array of passively deployed samples mounted on the development flight instrumentation pallet in the shuttle cargo bay. The directory of samples together with their intended measurements are presented. The plan for POSA data analysis is also given. R.C.T.

N81-20869# Honeywell Systems and Research Center, Minneapolis, Minn.

PROTOTYPE AUTOMATIC TARGET SCREENER Quarterly Progress Report, 1 Jul. - 31 Dec. 1979

R. C. Fitch, D. V. Serreyn, T. G. Kopet, R. C. Reitan, and M. O. Schroeder 19 May 1980 111 p

(Contract DAAK70-77-C-0248; DA Proj. 1E2-63710-DK-70) (AD-A095596; HONEYWELL-80SRC73; QPR-8) Avail: NTIS HC A06/MF A01 CSCL 17/5

This report covers hardware modifications we have made since the last report, the modification to include range target/clutter discrimination, and the general status of the PATS system. The program objective is to produce a design for an automatic target screener. The screener will reduce the task loading on the thermal imager operator by detecting and recognizing a

limited set of high-priority targets at ranges comparable to or greater than those for an unassisted observer. A second objective is to provide enhancement of the video presentation to the operator. The image enhancement includes: (1) automatic gain/brightness control to relieve the operator of the necessity of continually adjusting the display gain and brightness controls and (2) DC restoration to eliminate artifacts resulting from AC coupling of the infrared (IR) detectors. GRA

N81-20870# ITT Electro-Optical Products Div., Roanoke, Va.
ULTRA LOW LOSS OPTICAL FIBER CABLE ASSEMBLIES Semiannual Report, 1 May - 30 Nov. 1980
Robert Kopstein Fort Monmouth, N. J. Army Communication Research and Development Command Feb. 1981 70 p refs (Contract DAAB07-78-C-2922)
(AD-A095551; CORADCOM-78-2922-3) Avail: NTIS HC A04/MF A01 CSCL 20/6

Progress toward development of ruggedized ultra low loss (-8.0 db/km) optical fiber cable assemblies consisting of six optical fibers is reported. Effort involves investigations of fiber, cabling, and connector development on an individual as well as combined basis for meeting requirements of tactical tdm communication systems. During this reporting period final cable assemblies were fabricated, fiber and cable optimization for low temperature performance and impact survivability was completed, jacket polyurethane materials were evaluated, and connector/receptacle development work was finalized. GRA

N81-20871# Bell-Northern Research Ltd., Ottawa (Ontario).
EXPLORATORY DEVELOPMENT MODEL HERMAPHRODITIC FIBER OPTIC CONNECTORS Final Report, May 1979 - Nov. 1980
J. F. Dalgleish and H. H. Lukas Nov. 1980 66 p refs (Contract DAAK80-79-C-0771; DA Proj. 1L1-62701-AH-92)
(AD-A095276; CORADCOM-74-C-0771-F; BNR-TR-1-D42-07-80) Avail: NTIS HC A04/MF A01 CSCL 20/6

This final technical report documents the fiber alignment concept, a description of the connector plug and bulkhead receptacle, detailed installation procedures and a summary of the test results. Recommendations are made concerning final development of the connector. GRA

N81-20872# Los Alamos Scientific Lab., N. Mex.
STATISTICAL PROPERTIES OF VISIBLE AND INFRARED BEAMS RETROREFLECTED THROUGH A TURBULENT ATMOSPHERE
M. Slatkine, D. Bensimon, A. Englander, S. Shtrikman, and D. Treves 1980 5 p refs Presented at the 3rd Intern. Conf. on Lasers and Appl., New Orleans, 14-19 Dec. 1980 Prepared in cooperation with Weizmann Inst. of Science (Israel)
(Contract W-7405-eng-36)
(LA-UR-80-3674; CONF-801201-3) Avail: NTIS HC A02/MF A01

Statistical properties of HeNe and CO2 laser beams retroreflected through a turbulent atmosphere were investigated experimentally for round paths of 1 km and 12 km. Both heterodyne and direct detection were used. DOE

N81-20873# Los Alamos Scientific Lab., N. Mex.
ULTRAVIOLET PHASE CONJUGATION AND ITS PRACTICAL IMPLICATION
S. L. Shapiro (NBS, Washington, D.C.), R. A. Fisher, and B. J. Feldman 1981 6 p refs Presented at the SPIE Symp. on High Power Lasers and Appl., North Hollywood, Calif., 11-13 Feb. 1981 Submitted for publication
(Contract W-7405-eng-36)
(LA-UR-80-3621; CONF-810204-1) Avail: NTIS HC A02/MF A01

Using a 15 psec, 2660 A pulse, 0.1 percent conjugate reflectivities were obtained via degenerate four wave mixing in 1 mm samples of CS2 mixtures. While pure CS2 did not exhibit the effect, dilution in several UV transmitting solvents opened up a concentration tunable (2450 A - 2850 A) spectral window, allowing the optical Kerr effect to be utilized. Weaker phase conjugation at 2660 A was also observed in other Kerr media and in saturable absorber media. DOE

N81-20874# AEG-Telefunken, Ulm (West Germany). Forschungsinst.
DEVELOPMENT OF COMPONENTS FOR OPTICAL COMMUNICATIONS WITH LIGHT GUIDING FIBERS Final Report
Guenther Arnold, Franz-Joseph Berlec, Gisbert Glasmachers, Hartmut Gottsmann, Oskar Krumpholz, Peter Marschall, Stefan Maslowski, Klaus Petermann, Eugen Pfeiffer, Peter Russer et al Bonn Bundesministerium fuer Forschung und Technologie Apr. 1980 167 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-006; ISSN-0340-7608) Avail: NTIS HC A08/MF A01

Laser diodes as transmitters with photodiodes as receivers were developed for application in fiber optical communications systems. The processing steps involved in the fabrication of laser diodes were investigated and optimized, and the necessary equipment built up in the form of a pilot line. Measuring sets for determining laser characteristics were constructed and routine measurements of a large quantity of diodes together with supporting theoretical evidence were used to carry out the optimization. Results of particular interest include: for nonpassivated laser diodes, the medium lifetime is 10,000 to 15,000 hr and cw operating time exceeds 22,000 hr (heatsink temperature 40 C, output power 5 mW/mirror), the I-L characteristics are linear up to 10 mW; the near and far fields are stable and modulation is possible up to 1 Gbit/sec. For silicon avalanche photodiodes, the gain bandwidth product and the excess noise factor were investigated. Transmission photodiodes based on GaAs/GaAlAs were also developed for system applications.
Author (ESA)

N81-20875# Siemens A.G., Munich (West Germany). Forschungslab.
SOLID STATE IMAGERS Final Report
Heiner Herbst Bonn Bundesministerium fuer Forschung und Technologie Jun. 1980 111 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-009; ISSN-0340-7608) Avail: NTIS HC A06/MF A01

Image sensors based on CCD and CID imaging arrays were developed, emphasizing increased pixel content and density. Surface channel CCD's of Si-Si-gate configuration show transfer loss limits as low as 1 millionths. Using these devices long linear Imagers with 2000 pixels were built. The upper frequency limit is doubled by introduction the quadrilinear Imager concept. According to measurements on line arrays with pixel numbers up to 1024 this concept can be applied to facsimile and film scanners. Main emphasis concerning area Imagers was put on CID's rather than on CCD arrays because of their advantages regarding chip size and blooming sensitivity. With on-chip signal processing, the signal processing, the signal to fixed pattern noise ratio is invreased to 40dB, measured on a 100 x 100 pixel CID imager with Si-Si-gate structure. Proposals concerning image storage are made and partial test results for CID arrays are reported. Author (ESA)

N81-20876# AEG-Telefunken, Ulm (West Germany). Geschaeftsbereich Roehren und Baugruppen.
FLAT DISPLAY PANEL IN LIQUID CRYSTAL TECHNOLOGY Final Report
Juergen Steinbeck, Manfred Schiekel, Ruediger Unbehaun, Hans-Joest Herzog, Gerhard Haeberle, and Rudolf Biskupek Bonn Bundesministerium fuer Forschung und Technology Jun. 1980 167 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technology
(BMFT-FB-T-80-012; ISSN-0340-7608) Avail: NTIS HC A08/MF A01

Liquid crystal display panels were built using matrix configurations. With predeformed liquid crystal structures, steep electro-optic characteristics, and small on-off switching ratios, electrically controllable birefringence is obtainable. This allows the addressing of projection color matrix displays with up to 90 scanned lines in a two color representation and up to 40 lines in a four color representation at a rate of 50 frames per sec. The same holds for predeformed liquid crystals having the advantage of low operating voltages, such as commercially available CMOS IC's

Matrix displays with 32 x 32 and 80 x 80 picture elements with the corresponding electronic addressing devices for projection images with controllable color were assembled. Usint these twisted nematic (TN) liquid crystal displays, the possibility of color switching filters in a sequential color selection mode was investigated. An experimental setup consisting of a CRT with two color phosphor screen, a color switching filter with a TN cell, and on electronic addressing device for the synchronized switching of image signals and of the corresponding colors is described. Author (ESA)

N81-20877# Philips Zentrallaboratorium G.m.b.H., Hamburg (West Germany). Forschungsabt. Angewandte Physik.
INTEGRATED THIN-FILM LIGHT MODULATION LINES AND MATRICES Final Report
Peter Hansen, Bernhard Hill, Dieter Riekmann, and Klaus-Peter Schmidt Bonn Bundesministerium fuer Forschung und Technology Jun. 1980 125 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technology
(BMFT-FB-T-80-013; ISSN-0340-7608) Avail: NTIS HC A06/MF A01

Technology for the realization of high resolution, thin film, light modulation components is described. These components can be applied in optical printing devices (hard copy) with nonmechanical optical pattern generation or for data output display with inherent memory. One modulation technique is based on a thermal bond edge shift in cadmium sulfide crystals, electronically controlled by a thin film resistance network. A modulation line comprising 100 elements on a substrate was realized and experimentally tested. Another technique uses the Faraday effect in magneto-optic storage films. Modulation lines with 256 elements and a matrix with 64 x 64 elements were developed. These components can be switched at a data rate of up to 10 Mbit/sec. The resolution of the x-y addressed matrices can be increased in principle, resulting in components for high resolution data output displays. A laboratory model of a hard copy device was set up using two of the 256 element modulation lines. The optical recording of gra scale images with 512 points per line is demonstrated. Author (ESA)

N81-20804# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphere.
THE OPTICAL CONTRAST OF LAND AND SEA TARGETS
H.-E. Hoffman *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 10 p refs (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

N81-20805# Naval Air Development Center, Warminster, Pa.
AN APPROACH TO AIRBORNE INFRARED SEARCH SET PERFORMANCE MODELING
Nancy E. MacMeekin *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 10 p refs (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

N81-20806# Etablissement Technique Central de l'Armement, Arcueil (France).
TARGET DETECTION AND CLASSIFICATION IN INFRARED IMAGERY [DETECTION ET CLASSIFICATION DE CIBLES EN IMAGERIE INFRA-ROUGE]
Jean Louchet *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 11 p In FRENCH (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

N81-20812# British Aerospace Dynamics Group, Hatfield (England). Infra-Red Equipment Div.
RESEARCH INTO METHODS OF IMAGE PROCESSING FOR TARGET ENHANCEMENT AND DETECTION
D. B. Duke, A. J. Fryer, and P. A. Bird *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 17 p ref (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

N81-20818# EMI Electronics Ltd., Feltham (England).
TARGET TRACKING USING AREA CORRELATION
R. M. B. Jackson *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 8 p (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

N81-20820# Forschungsinstitut fuer Informationsverarbeitung, Karlsruhe (West Germany).
TARGET TRACKING AND TARGET DETECTION IN TV- AND FLIR-IMAGERY
M. Bohner *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 17 p refs (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

N81-20821# Elektronik-System G.m.b.H., Munich (West Germany).
TARGET IDENTIFICATION OF AIRCRAFT USING IR/TV-SENSOR-IMAGES
Dirk Meyer, Manfred Mueller, and Andreas Weimann *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 18 p refs (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

N81-20822# Honeywell Systems and Research Center, Minneapolis, Minn.
AUTONOMOUS TARGET SCREENERS
R. K. Aggarwal, M. Geokezas, and D. E. Soland *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 14 p refs (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

N81-20823# Army Night Vision Lab., Fort Belvoir, Va.
EVALUATION OF A REALTIME PROTOTYPE AUTOMATIC TARGET CUER
Terry L. Jones *In* AGARD Image and Sensor Data Process. for Target Acquisition and Recognition Nov. 1980 7 p (For primary document see N81-20803 11-70)
Avail: NTIS HC A12/MF A01

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N81-20878 Johns Hopkins Univ., Baltimore, Md.
A STUDY OF IMPURITY TRANSPORT WITH AN EUV SPATIAL IMAGING DETECTOR SYSTEM ON THE ALCATOR A TOKAMAK Ph.D. Thesis
Steven Lynn Allen 1981 220 p
Avail: Univ. Microfilms Order No. 8106587

To determine if impurities were concentrated in the Alcator A Tokamak, as predicted by theory, it was studied with an absolutely calibrated extreme ultraviolet monochromator. The instrument was equipped with a Spatial imaging detector system so that radial emission profiles were obtained in a single discharge. The design, calibration, and operation of the system are described in detail. The characteristics of radial impurity transport were obtained by artifically introducing neutral atoms into the plasma with a laser injection system. The decay of the emission from the injected impurity indicated that it was leaving the plasma, and that it did not accumulate in the core of the discharge. The experimental results were compared with theoretical models of neoclassical transport and a qualitative disagreement was noted. The decay of the emissions of the ionization states is related to the impurity confinment time; this decay time was studied under various plasma conditions and general scaling relationships are presented. The characteristics of toroidal transport were studied by observing emissions from intrinsic light impurities at various locations on the Tokamak. Dissert. Abstr.

N81-20879 Princeton Univ., N. J.
ENERGY PRINCIPLE WITH GLOBAL INVARIANTS Ph.D. Thesis
Amitava Bhattacharjee 1981 123 p
Avail: Univ. Microfilms Order No. 8104842

A variational principle is proposed for constructing equilibria with minimum energy in a toroidal plasma. The total energy is minimized subject to global invariants which act as constraints during relaxation of the plasma. These global integrals of motion are preserved exactly for all ideal motions and approximately for a wide class of resistive motions. It is assumed specifically, that relaxation of the plasma is dominated by a tearing mode of single helicity. Equilibria with current density vanishing on the boundary are constructed for plasmas of zero beta. It is possible to include in this theory equilibrium states with nonzero pressure gradients. Theoretical predictions are compared in detail with experimental data on self-reversal of the toroidal field in reversed field pinches. The theory is also used to study major disruptions and current penetration in Tokamaks. The second variation of the free energy functional is computed. It is shown that if the second variation of any equilibrium constructed in this theory is positive, the equilibrium satisfies the necessary and sufficient conditions for ideal stability. Dissert. Abstr.

N81-20880 Wisconsin Univ. - Madison.
ION HEATING IN THE ION CYCLOTRON RANGE OF FREQUENCIES IN THE WISCONSIN TOKAPOLE 2 Ph.D. Thesis
Alan Pardy Biddle 1980 189 p
Avail: Univ. Microfilms Order No. 8025812

Ion temperatures of 75 eV, a doubling of the ohmic heating temperature in a normal discharge, was achieved using the fast magnetosonic wave heating at the second, third, and fourth harmonics of the cyclotron frequency in a single component hydrogen plasma. Enhanced neutral density caused by poor ion confinement and edge heating resulting from the limited number of modes accessible was observed. The use of a self excited oscillator resulted in a limited passive mode tracking capability with improvements in power deposition of about 40% over a constant frequency source. Plasma density increases about 20% with the application of RF with a resulting termination of the discharge approximately 10% earlier than without RF. Spectroscopic data indicates that hoop bombardment causing a 15 fold increase in copper radiation may be a primary source of the density increase as well as an important energy loss channel. Charge exchange has been found to be the dominant loss mechanism in the intermediate temperature region with gyroradius effects being the limiting factors at the highest temperature.
Dissert. Abstr.

N81-20881 Johns Hopkins Univ., Baltimore, Md.
OSCILLATING GRID TURBULENCE, INCLUDING THE EFFECTS OF ROTATION Ph.D. Thesis
Stuart Chapman Dickinson 1981 155 p
Avail: Univ. Microfilms Order No. 8106603

An oscillating grid is typified by an action K of the dimensions and character of eddy viscosity. By starting an oscillating grid located at the plane z = 0 at the time t = 0, a front separating the turbulent from the nonturbulent fluid propagates away. Dimensional analysis predicts the distance d of this front from z = 0 will obey d varies as the square root of (Kt). This behavior was observed experimentally. In the case of a rotating front, the rotation Omega (which is parallel to z) is an additional parameter. Two dimensionless numbers can be found d/square rate of K/Omega and Omega-t for example. The former implies the existence of a layer beyond which turbulence cannot extend. This layer was observed in two ways: directly, as a depth beyond which the turbulence could no longer exist with horizontal homogeneity, and indirectly as the point where the propagation of a front changed from a diffusive d varies as the square rate of t to a wave like d varies as to behavior. Fitting d/square rate of K/omega - D (a universal constant for a large enough Reynolds number), D perspective to 2 was measured for both methods. Dissert. Abstr.

N81-20882 Cornell Univ., Ithaca, N. Y.
SIMULATION STUDIES OF THE STABILITY OF WEAK AND STRONG ION LAYERS AND RINGS Ph.D. Thesis
Alex Friedman 1980 288 p
Avail: Univ. Microfilms Order No. 8102914

Investigations are described of the low frequency stability of strong ion rings carried out using time dependent computer simulation methods. The simulation program developed is a linearized three dimensional hybrid code called RINGHYBRID. This program models a strong ion ring (represented by discrete simulation superparticles) in a plasma consisting of a cold, uniform background ion component and an inertialess electron component of density appropriate for local quasineutrality (both modeled by fluid equations). A method of generating quiescent equilibria through the addition of a resistive relaxation term to the zero order field equation is described. The stability of infinite layer equilibria is examined. Both stable and unstable kink and precessional motions are observed; the unstable = 1 motion in a radially decreasing field can be identified with the so-called MHD precession. The stability of thin, weak rings is described. Effects of ergodic single particle orbits are observed in the simulations; due to the structural instability of particle trajectories, neighboring orbits diverge exponentially with time.Dissert. Abstr.

N81-20883 Wisconsin Univ. - Madison.
IMPACT OF PLASMA WALL INTERACTIONS ON THE BURN DYNAMICS OF TOKAMAK REACTORS Ph.D. Thesis
Michael Raymond Gordinier 1980 205 p
Avail: Univ. Microfilms Order No. 8023409

A zero dimensional edge model was developed which incorporates the relevant plasma wall interactions of the scrape-off zone. This model provides the self consistent boundary conditions and fuel/impurity influxes required by one dimensional radial transport codes. By coupling the two modes, the impact of plasma wall interactions on the burn dynamics of Tokamaks can be assessed. Simulations using this edge model demonstrated the impurity control features of a cool gas blanket under a wide variety of gas flow rates. While the simulations were not carried to plasma equilibrium, the transfer creation and operation of a gas blanket was observed. Dissert. Abstr.

N81-20884 Maryland Univ., College Park.
ELECTRON HEATING IN A HIGH VOLTAGE TOROIDAL THETA PINCH Ph.D. Thesis
Robert Louis Merlino 1980 151 p
Avail: Univ. Microfilms Order No. 8104962

Rapid heating of electrons to keV temperatures was investigated in a high voltage toroidal theta pinch with bias fields either parallel or antiparallel to the fast rising implosion field. The heating results were obtained from an analysis of plasma. X-ray emission and spatially resolved X-ray emission from aluminum targets in the plasma. Electron temperatures are determined from X-ray filter transmission ratios and the density of heated electrons is estimated from absolute X-ray intensities. In both bias configurations, superthermal electron distributions were observed corresponding to a small fraction (< 1 percent) of the bulk electron distribution, indicating that the turbulent heating process involves electron tail formation. Substantial bulk electron heating was observed with antiparallel bias fields with heating rates in reasonable agreement with the predictions of microinstability theory. Anomalous cross field diffusion of hot electrons appears as a plausible mechanism for transporting hot electron energy out of the neutral layer and into the bulk plasma in the antiparallel bias configuration. Dissert. Abstr.

N81-20885 Wisconsin Univ. - Madison.
DRIFT-CYCLOTRON LOSS-CONE INSTABILITY IN THE PRESENCE OF THE EXTERNAL WAVE FIELDS Ph.D. Thesis
Ker-Chung Shaing 1980 104 p
Avail: Univ. Microfilms Order No. 8023432

The effect of the lower hybrid wave field on the electrostatic drift cyclotron loss cone mode is studied and stabilization frequency regions are identified. Particles orbits in the fast wave fields are calculated. It is found that the particle trapping effect at frequency omega sub 0 = N omega sub ci, where n is an integer, can be neglected if the electric field strength E is less than a critical field strength. Thus, the important nonlinear process is still wave coupling process. Fast wave fields will destablize the drift cyclotron loss cone mode omega sub 0 = 2 omega sub ci but can stablize the mode at omega sub 0< 2 omega sub ci for certain values

of plasma beta. The fast wave at the center of the Phaedrus tandem mirror experiment shoud stabilize the drift cyclotron loss cone mode for both beta = 30 percent and 7.5 percent.
Dissert. Abstr.

N81-20886 California Univ., Davis.
AN EXPERIMENTAL STUDY OF FINITE LARMOR RADIUS EFFECTS IN A LINEAR Z-PINCH Ph.D. Thesis
Kenneth William Struve 1980 204 p
Avail: Univ. Microfilms Order No. 8105413

Linear Z-pinches in Ar, Kr, Xe, N2, and He are experimentally studied in regimes where strong finite Larmor radius effects could provide a significant stabilizing effect. For higher Z plasmas a higher line density is allowed, the exact value of which depends on the average ion charge. The primary diagnostics are a framing camera, a spatially resolved Mach-Zehnder interferometer, and X-ray absorption. Observed linear pinch instabilities have growth rates more than a factor of ten less than the MHD model. Instability types are found to scale with the ratio of the finite Larmor radius divided by the pinch radius, which requires determining the average ion charge for higher Z plasmas.
Dissert. Abstr.

N81-20887# Wisconsin Univ. - Madison. Dept. of Nuclear Engineering.
COMMERCIAL TANDEM MIRROR REACTOR DESIGN WITH THERMAL BARRIERS: WITAMIR-I
G. L. Kulcinski, C. W. Emmert, C. W. Maynard, K. Audenaerde, J. B. Beyer, D. Braun, J. D. Callen, J. M. Gilmour, J. Kesner, D. C. Laralestier et al Oct. 1980 15 p refs Presented at the 4th ANS Topical Meeting on the Technol. of Controlled Nucl. Fusion, King of Prussia, Pa., 14-17 Oct. 1980
(UWFDM-375) Avail: NTIS HC A02/MF A01

A conceptual design of a near term commercial tandem mirror power reactor is presented. The basic configuration utilizes yin-yang minimum B plugs with inboard thermal barriers. The maximum magnetic fields are 6.1 T, 8.1 T, and 15 T in the central cell, yin-yang, and thermal barrier magnets, respectively. The blanket utilizes Pb83Li17 as the coolant and HT-9 as the structural material. This yields a high energy multiplication (1.37), a sufficient tritium breeding ratio (1.07) and has a major advantage with respect to maintenances. The plasma Q is 28 at a fusion power level of 3000 MW(t); the net electrical output is 1530 MW(e); and the overall efficiency is 39 percent. Cost estimates indicate that WITAMIR-I is competitive with recent Tokamak power reactor designs. DOE

N81-20888# Nagoya Univ. (Japan). Engineering Science Lab.
TWO-CENTRE COULOMB PHASESHIFTS AND RADIAL FUNCTIONS
Hiroki Nakamura and Hidekazu Takagi (Kitasato Univ., Sagamihara, Japan) Dec. 1980 86 p refs Submitted for publication
(IPPJ-AM-16) Avail: NTIS HC A05/MF A01

Two-center radial Coulomb functions and phaseshifts are calculated numerically, and are tabulated. Only the homonuclear case is considered. Author

N81-20889*# National Aeronautics and Space Administration, Washington, D. C.
PLASMA CHEMISTRY FOR INORGANIC MATERIALS
O. Matsumoto Dec. 1980 12 p refs Transl. into ENGLISH from Purazuma to Kagaku (Japan), Apr. 1980 p 49-52 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Aoyama Univ., Japan
(Contract NASw-3199)
(NASA-TM-75844) Avail: NTIS HC A02/MF A01 CSCL 20I

Practical application of plasma chemistry to the development of inorganic materials using both low temperature and warm plasmas are summarized. Topics cover: the surface nitrification and oxidation of metals; chemical vapor deposition; formation of minute oxide particles; the composition of oxides from chloride vapor; the composition of carbides and nitrides; freezing high temperature phases by plasma arc welding and plasma jet; use of plasma in the development of a substitute for petroleum; the production of silicon for use in solar cell batteries; and insulating the inner surface of nuclear fusion reactor walls. A.R.H.

N81-20890# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
[RESEARCH DURING 1979 IN PLASMA PHYSICS AND CONTROLLED FUSION] Annual Report
B. Lehnert Jan. 1980 17 p refs
(TRITA-PFU-80-01) Avail: NTIS HC A02/MF A01

Plasma-neutral gas interations in cold mantle systems were investigated. Magnetic confinement studies included computations on longitudinal invariant surfaces in Intrap configurations. The parameter ranges and scaling laws of a small scale straight Extrap pinch were examined. The conditions of a fully developed cold blanket state were satisfied within relevant parameter ranges. A stability condition for kink-like modes was deduced which replaces the Kruskal-Shafranov limit and predicts that stabilizatior should become possible for long wavelength kinks. Investigations on radio frequency heating of a magnetically confined plasma were continued. Equations for resonances and cut offs of the fast Alfven and ion-cyclotron waves were derived for a multicomponent plasma in a toroidal axisymmetric geometry. The continuous Alfven wave spectrum was computed for the Intrap internal ring device FIVA, and the fast magnetosonic wave spectrum was calculated for a transversely magnetized plasma cavity. Plasma diagnostics methods are examined. Author (ESA)

N81-20891# Naval Research Lab., Washington, D. C. Laser Plasma Branch.
CHARACTERISTICS OF ABLATION PLASMA FROM PLANAR, LASER-DRIVEN TARGETS Interim Report
J. Grun (Mission Research Corp., Alexandria, Va.), R. Decoste (Inst. de Recherche d'Hydro-Quebec), B. H. Ripin, and J. Gardner 9 Mar. 1981 16 p refs
(AD-A095667; NRL-MR-4410) Avail: NTIS HC A02/MF A01 CSCL 20/9

The momentum, energy, and velocity characteristics of plasma ablating from planar targets irradiated by long Nd laser pulses (4 nsec, + 10 to the 14th power W/sq cm) are measured and the dependence of relation parameters upon absorbed irradiance is determined. Large laser spots are used in these experiments so that the results are not sensitive to boundary effects. GRA

N81-20892# Naval Postgraduate School, Monterey, Calif. Dept. of Aeronautics.
ELECTRODE BOUNDARY LAYERS IN DENSE, DIFFUSE PLASMAS Final Report, 1 Sep. 1978 - 31 Mar. 1980
Oscar Biblarz, R. E. Ball, and S. T. VanBrocklin Oct. 1980 105 p refs
(Contract AFOSR MIPR-00618-79; AF Proj. 2308)
(AD-A095250; NPS67-80-011; AFWAL-TR-80-2088) Avail: NTIS HC A06/MF A01 CSCL 20/9

This report presents a description of two dimensional current flow at non-emitting electrodes. The plasma is generated by an E-beam or other external source. Diffusion and ionization/recombination are accounted for in the formulation but neither convection nor magnetic field effects are included. Results for a potential drop at the electrode region of 10 volts clearly indicate the boundary-layer nature of the sheath; the boundary-layer nature of the ambipolar region shows up when ionization/recombination are included. Various physical and numerical arguments are given for the dimensionality of the problem and a description of the calculation scheme together with the computer program are included. GRA

N81-20893# Avco-Everett Research Lab., Mass.
INVESTIGATION OF THE PRODUCTION OF HIGH DENSITY UNIFORM PLASMAS Final Report, 10 Jul. 1979 - 10 Apr. 1980
D. H. Douglas-Hamilton and P. S. Rostler Wright-Patterson AFB, Ohio AEWAL Oct. 1980 44 p
(Contract F33615-78-C-2013; AF Proj. 2308)
(AD-A095508; AFWAL-TR-80-2087) Avail: NTIS HC A03/MF A01 CSCL 20/9

The cathode layer instability which leads to the initiation of streamers in non-self-sustaining discharges is studied by shadowgraph photography. The effects of cathode material and discharge gas composition are investigated. A theoretical model of the instability is formulated and compared with the data. Framing camera color photographs of streamers are obtained

and shown to be consistent with a previously developed theory of streamer propagation. GRA

N81-20894# TRW Defense and Space Systems Group, Redondo Beach, Calif.
SYMMETRIC TANDEM MIRROR PROGRAM Annual Progress Report, period ending Oct. 1980
Oct. 1980 61 p refs
(Contract DE-AC03-79ET-51017)
(DOE/ET-51017/T1) Avail: NTIS HC A04/MF A01

A technique for measuring the spatial distribution of the diamagnetism of the energetic electron plasma was developed. Using this technique, it was determined that high-(BETA) plasmas ((BETA) approx. 50%) are indeed produced with their pressure peak near the second harmonic locations in the plane midway between the mirror coils. Measurements of the cold plasma properties (Te, n/sub e/) led to deeper understanding of the plasma equilibrium. It was found that the electron temperature is controlled by adjustment of the neutral density (10 < Te < 50 eV). The cold plasma density is determined by the applied power. It was found that the minimum ratio of cold to hot electron density for which stable equilibria exist is approximately unity (with an uncertainty of a factor of three remaining in the measurements). DOE

N81-20895# California Univ., Livermore.
FORMATION OF COMPACT TOROIDAL PLASMAS BY MAGNETIZED COAXIAL PLASMA GUN INJECTION INTO AN OBLATE FLUX CONSERVER
W. C. Turner, G. C. Goldenbaum, E. H. A. Grannsman, C. W. Hartman, D. S. Prono, J. Taska, and A. C. Smith, Jr. (Pacific Gas and Electric Co., San Francisco) 4 Nov. 1980 12 p refs Presented at the 3rd Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program, Los Alamos, N. Mex., 2-4 Dec. 1980
(Contract W-7405-eng-48)
(UCRL-85122; CONF-801215-5) Avail: NTIS HC A02/MF A01

Initial results are reported on the formation of compact toroidal plasmas in an oblate shaped metallic flux conserver. A schematic of the experimental apparatus is shown. The plasma injector is a coaxial plasma gun with solenoid coils wound on the inner and outer electrodes. The electrode length is 100 cm, the diameter of the inner (outer) electrode is 19.3 cm (32.4 cm). Deuterium gas is puffed into the region between electrodes by eight pulsed valves located on the outer electrode 50 cm from the end of the gun. The gun injects into a cylindrically symmetrical copper shell (wall thickness = 1.6 mm) which acts as a flux conserver for the time scale of experiments reported here. The copper shell consists of a transition cylinder, a cylindrical oblate pill box, and a downstream cylinder. The gap between the gun and transition cylinder is 6 cm. An axial array of coils outside the vacuum chamber can be used to establish an initial uniform bias field. DOE

N81-20896# Los Alamos Scientific Lab., N. Mex.
PHYSICAL PROPERTIES OF COMPACT TOROIDS GENERATED BY A COAXIAL SOURCE
I. Henins, H. W. Hoida, T. R. Jarboe, R. K. Linford, J. Marshall, K. F. McKenna, D. A. Platts, and A. R. Sherwood 1980 5 p refs Presented at the 3rd Symp. on the Phys. and Technol. of Compact Toroids in the Magnetic Fusion Energy Program, Los Alamos, N. Mex., 2-4 Dec. 1980
(Contract W-7405-eng-36)
(LA-UR-80-3238; CONF-801215-6) Avail: NTIS HC A02/MF A01

Compact toroids (CTs) generated with a magnetized coaxial plasma gun are studied. CTs were generated in prolate and oblate cylindrically symmetric metallic flux conservers. The plasma and magnetic field properties are studied through the use of magnetic probes, Thomson scattering, interferometry, and spectroscopy. DOE

N81-20897# Oak Ridge National Lab., Tenn. Fusion Energy Div.
APPROACH TO IGNITION OF TOKAMAK REACTORS
D. J. Sigmar (MIT) Feb. 1981 47 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7552) Avail: NTIS HC A03/MF A01

Transport modeling results for JET, INTOR, and ETF are reviewed and analyzed with respect to existing uncertainties in the underlying physics, the self-consistency of the large numerical codes, and the margin for ignition. The codes show ignition to occur in ETF/INTOR-sized machines if empirical scaling is extrapolated to ion temperatures (and beta values) much higher than those presently achieved, if there is no significant impurity accumulation over the first 7 s, and if the known ideal and resistive MHD instabilities remain controllable for the evolving plasma profiles during ignition startup. DOE

N81-20898# Oak Ridge National Lab., Tenn.
PLASMA FLUCTUATION MEASUREMENTS IN ELMO BUMPY TORUS
A. Komori Jan. 1981 34 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7530) Avail: NTIS HC A03/MF A01

Spatially resolved density fluctuation measurements in the dc frequency range up to 500 kHz were conducted on the ELMO Bumpy Torus (EBT-I) plasma using photodetectors and Langmuir probes. Plasma currents produced by microwave-heated hot electron annuli were found to reduce fluctuations of toroidal plasma to low levels. The mechanism of stabilization was studied. Large amplitude fluctuations that accompany the hot electron annuli that destroy a stable plasma confinement were observed at low neutral pressure. DOE

N81-20899# Oak Ridge National Lab., Tenn.
NEOCLASSICAL CURRENT EFFECTS IN NEUTRAL BEAM-HEATED TOKAMAKS
J. T. Hogan Jan. 1981 74 p refs Submitted for publication
(Contract W-7405-eng-26)
(ORNL/TM-7611) Avail: NTIS HC A04/MF A01

There is a long-standing prediction from neoclassical theory that strong contributions to the toroidal current should be driven by friction between trapped and passing particles when (BETA)/ sub pol/ exceeds (RADICAL)R/a in a Tokamak. A number of neutral beam heating experiments produce such parameters, and the behavior which occurs in this regime is calculated to determine the feasibility of using such a bootstrap current as a steady-state Tokamak current source. The neoclassical current, if present, can have a value no larger than 25 percent of its theoretically calculated value. Since the neoclassical particle (Ware) pinch is strongly related to the neoclassical current in the theory (Onsager reciprocity), the existence of the particle pinch is called into question. DOE

N81-20900# Massachusetts Inst. of Tech., Cambridge. Plasma Fusion Center.
MASSACHUSETTS INSTITUTE OF TECHNOLOGY, PLASMA FUSION CENTER, TECHNICAL RESEARCH PROGRAMS
Aug. 1980 94 p
(Contract DE-AS02-76ET-52002)
(DOE/ET-52002/T1; PFC/RR80-18) Avail: NTIS HC A05/MF A01

A review is given of the technical programs carried out by the Plasma Fusion Center. The major divisions of work areas are applied plasma research, confinement experiments, fusion technology and engineering, and fusion systems. DOE

N81-20901# Los Alamos Scientific Lab., N. Mex. Laser Fusion Program Sect.
INERTIAL FUSION PROGRAM Progress Report, 1 Jul. - 31 Dec. 1978
Roger B. Perkins and Frederick Skoberne, comp. Nov. 1980 135 p refs
(Contract W-7405-eng-36)
(LA-7755-PR) Avail: NTIS HC A07/MF A01

Progress in the development of high energy short pulse CO2 laser systems for fusion research is reported. Improvements to a two-beam system, Gemini, are outlined and experimental results discussed. An eight-beam system, Helios, was fired successfully on target for the first time, and became the world's most powerful gas laser for laser fusion studies. Work on Antares, a 100 to 200 TW target irradiation system, is summarized. A baseline design for automatic centering of laser beams onto the various relay mirrors and the optical design of the Antares front

end are discussed. The results of various fusion reactor studies are summarized, as well as investigations of synthetic-fuel production through application of fusion energy to hydrogen production by thermochemical water splitting. Studies on increased efficiency of energy extraction in CO2 lasers and on lifetimes of cryogenic pellets in a reactor environment are summarized, as well as the results of studies on pellet injection, tracking, and beam synchronization. DOE

N81-20902# Illinois Univ., Urbana. Fusion Studies Lab.
CHARGED-PARTICLE CROSS SECTION DATA FOR FUSION PLASMA APPLICATIONS
George H. Miley 1980 35 p refs Presented at the Workshop on Nucl. Data Evaluation Methods and Procedures, Upton, N.Y., 22-26 Sep. 1980
(Contract DE-AS02-76ET-52040)
(COO-2218-195; CONF-800979-12) Avail: NTIS HC A03/MF A01

Cross-section data for fusion plasma calculations are reviewed for three categories: fusion reactions; nuclear elastic and inelastic scattering. Increasing emphasis on advanced fuel fusion introduces requirements for new reaction rate and charged particle scattering data over a wider range of reacting species (light elements through (11)B) and over a larger energy range (to several MeV). These new needs are discussed along with suggestions for increased emphasis on providing the user with more convenient compilations. In particular, the extension of reactivities (less than sigma V) to nonMaxwellian distributions, scattering matrix data, and development of computer based files are noted. DOE

N81-20903# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
FUSION TECHNOLOGY DEVELOPMENT: FIRST WALL/ BLANKET SYSTEM AND COMPONENT TESTING IN EXISTING NUCLEAR FACILITIES
Peter Y. S. Hsu, Theodore S. Bohn, Gary A. Deis, Jerry L. Judd, Glen R. Longhurst, Lowell G. Miller, A. Jerry Scott, and Daniel E. Wessol Dec. 1980 196 p refs
(Contract DE-AC07-76ID-01570)
(EGG-FT-5281) Avail: NTIS HC A09/MF A01

A concept to produce a reasonable simulation of a fusion first wall/blanket test environment employing an existing nuclear facility, is presented. An asymmetric, nuclear test environment with surface and volumetric heating rates similar to those expected in a fusion first wall/blanket or divertor chamber surface appears feasible. The concept takes advantage of nuclear reactions within the annulus of an existing test space (15 cm in diameter and approximately 100 cm high) to provide an energy flux to the surface of a test module. The principal reaction considered involves (3)He in the annulus as follows: n + (3)He (ARROW) p + t + 0.75 MeV. Bulk heating in the test module is accomplished by neutron thermalization, gamma heating, and absorption reactions involving (6)Li in the blanket breeding region. DOE

N81-20904# California Univ., Livermore. Lawrence Livermore Lab.
MIRROR FUSION TEST FACILITY MAGNET SYSTEM Final Design Report
C. D. Henning, A. J. Hodges, J. H. VanSant, E. N. Dalder, R. E. Hinkle, J. A. Horvath, R. M. Scanlan, D. W. Shimer, R. W. Baldi, and R. E. Tatro 3 Sep. 1980 129 p refs
(Contract W-7405-eng-48)
(UCRL-52955) Avail: NTIS HC A07/MF A01

The Mirror Fusion Test Facility magnet design is first described followed by a discussion of each phase of the development process. Specifically, superconducting manufacture, mechanical behavior of conductor winding, and coil winding are considered along with thermal analysis, cryogenic system, and power supply system. Also, structural analysis, structural finite element analysis refinement, structural case fault analysis, and structural metallurgy are addressed. The MFTF combines and extends the near-classical plasma confinement achieved in 2X11B with the most advanced neutral beam and magnet technologies available. The product of ion density and confinement time is improved while the superconducting magnet weight is extrapolated from 15 tons in Baseball 2 to 375 tons in MFTF. J.M.S.

N81-20905# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR).
ABSORPTION OF LASER RADIATION IN A PLASMA WITH SUBCRITICAL DENSITY
V. V. Aleksandrov, V. D. Vikharev, P. G. Kovalskii, M. I. Pergament, and A. M. Rubenchik Nov. 1980 18 p refs Transl. into ENGLISH of Rept. IAE-3198 Kurchatov Atomic Energy Inst., Moscow, 1979 Prepared for Calif. Univ., Lawrence Livermore Lab.,
(UCRL-Trans-11633; IAE-3198) Avail: NTIS HC A02/MF A01

Results are given of experimental research on the absorption of laser radiation by a plasma under conditions where all absorption mechanisms due to processes occurring in the region with a density of approximately n sub cr are excluded. Special attention is paid to absorption in the zone n is approximately n sub cr/4; this absorption is associated with the development of the two-plasmon decay instability. DOE

N81-20906# Georgia Inst. of Tech., Atlanta. School of Nuclear Engineering.
FUSION STUDIES PROGRAM Annual Report, 1 Nov. 1979 - 31 Oct. 1980
W. M. Stacey, Jr. 1980 64 p refs
(Contract DE-AS05-78ET-52025)
(DOE/ET-52025/3) Avail: NTIS HC A04/MF A01

The effect of a localized magnetic perturbation on magnetic islands in a cylindrical plasma, and a divertor magnetic field line following code are addressed. DOE

N81-20907# California Univ., Livermore. Lawrence Livermore Lab.
ORBIT AVERAGED RADIAL BUILDUP CODE FOR TANDEM MIRROR GEOMETRY
M. Campbell and A. H. Futch 22 Jan. 1981 24 p refs
(Contract W-7405-eng-48)
(UCID-18905) Avail: NTIS HC A02/MF A01

The radial Fokker-Planck (RFP) model of A. Futch was modified to treat plasma buildup in the tandem mirror plug and center cell with a self-consistent model (TOARBUC). Two major changes have been made to the original version of this code. First, the center cell is treated as having separate electron and ion confining potentials with the ion potential having the opposite sign of that in a conventional mirror. Second, a two-electron temperature treatment derived by R. Cohen was included in the present model to allow the plug and center cell to have different T-sub e/'s as observed in the experiment. The following sections explain these changes in greater detail. GRA

N81-20908# Mathematical Sciences Northwest, Inc., Bellevue, Wash.
AXIAL SHOCK WAVE HEATING OF REVERSED-FIELD THETA-PINCH PLASMAS
Loren Steinhauer Nov. 1980 52 p refs Sponsored in part by Electric Power Research Inst.
(Contract DE-AC06-80ER-53098; EPRI Proj. 922-4)
(MSNW-81-1158-1) Avail: NTIS HC A04/MF A01

Reversed field theta pinches are known to contract rapidly in the axial direction soon after the radial implosion. Under certain conditions the axial implosion can be quite strong. A model is described which simulates both the radial and axial implosions. Among the important features included are realistic plasma density profiles and current driven anomalous transport. Given input parameters such as initial fill pressure, bias magnetic field, coil size, applied voltage (or electric field) and compression magnetic field, the model predicts the final plasma temperature, density, radial and axial dimensions, trapped magnetic flux and fraction of particles trapped within the separatrix. The results indicate very strong axial shock heating for high bias field which leads to temperatures up to several times that predicted for simple field free plasmas. The model is applied to parameters characteristic of two recent experiments, and several features of the calculated results are shown to be consistent with experimental observations. It is also applied to a fusion reactor scale plasma: as a result of strong axial shock heating, the model predicts that fusion ignition (e.g., a temperature of 8 keV) can be achieved without resort to large electric field or large magnetic compression. DOE

N81-20909# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
ENERGIZATION OF ELECTRONS IN A PLASMA BEAM ENTERING A CURVED MAGNETIC FIELD
N. Brenning, L. Lindberg, and A. Eriksson (Ellemetal AB) Sep. 1980 29 p refs Sponsored by Swedish National Science Research Council
(TRITA-EPP-80-09; ISSN-0348-7539) Avail: NTIS HC A03/MF A01

Recently developed He-spectroscopy methods based on the absolute intensities of the He I 3889A and the He II 4686A lines are used to study electron temperatures and to estimate nonthermal electron populations, earlier work having indicated the existence of suprathermal electrons. The results obtained show that as many as 20 to 25% of the electrons gain energies in excess of 100 eV. The process appears to be particularly efficient on the side of the plasma beam becoming polarized when entering the curved field. Details are given on the electric field and potential structure. Electric field components parallel to the magnetic field are likely to energize the elections probably via the run-away phenomenon. Author (ESA)

N81-20910# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
NEUTRON SPECTRA FROM BEAM-HEATED FUSION PLASMAS. RESEARCH AND TRAINING PROGRAM ON CONTROLLED THERMONUCLEAR FUSION AND PLASMA PHYSICS (EUR-NE)
J. Scheffel and T. Elevant Aug. 1980 43 p refs Sponsored by Euroepan Communities and JET Joint Undertaking
(TRITA-PFU-80-09; ISSN-0348-7644) Avail: NTIS HC A03/MF A01

Studies of neutron emission rates and energy distributions were carried out for hot Maxwellian deuterium and tritium plasmas (several keV) and for Maxwellian deuterium and tritium plasmas heated by injected neutral deuterium beams. A numerical method was used to determine neutron energy spectra as a function of the plasma parameters. Experimental results indicate that neutron spectra resulting from beam-plasma and plasma-plasma interactions exhibit well defined energy separation characteristics for certain parameter ranges. Neutrons from plasma-plasma interaction provide information about the ion temperature and in some cases, ion density. Neutron spectra and reactivities plasma interactions depend strongly on the beam deposition profile, electron temperature and effective plasma charge. Author (ESA)

N81-20911# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
IDEAL MHD EQUILIBRIUM OF A WEAKLY TOROIDAL PLASMA COLUMN WITH ELONGATED CROSS SECTION. PART 2: FORCE-FREE FIELDS
E. J. M. vanHeesch and W. Schuurman Jul. 1980 18 p refs Sponsored by Euratom and Nederlandse Organisatie voor Zuiver-Wetenschappelijk Onderzoek (ZWO)
(Rept-80-124-Pt-2) Avail: NTIS HC A02/MF A01

Solutions of the ideal MHD equations are obtained describing the equilibrium of a weakly toroidal plasma with an elliptic cross section surrounded by a force-free magnetic field with constant ratio between current density and magnetic field strength. The force-free field parameter causes the stagnation points to recede along the major axis of the ellipse. Above a certain value of the force-free field parameter stagnation points do not exist, so that the compression ratio of the plasma column is no longer limited. The analysis was carried out to first order in the force-free field parameter as well as to second order for an estimate of the error. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N81-20912 Arizona Univ., Tucson.
THE RETARDATION OF CRYSTALLIZATION OF CVD AMORPHOUS SILICON AND THE STUDY OF ITS STRUCTURAL AND OPTICAL PROPERTIES Ph.D. Thesis
Donald Clarke Booth 1980 271 p
Avail: Univ. Microfilms Order No. 8102243

Amorphous silicon alloys containing boron, carbon, germanium, and nitrogen were prepared using chemical vapor deposition (CVD) and the effects of composition on their optical and structural properties for use as high temperature stable absorbers in photothermal solar energy conversion were determined. It was found that the ratio of silicon to alloy element in the film was not in general the same as in the gas mixture. The structure of all as-deposited alloy films was amorphous. The profiles of the absorption coefficients of the as-deposited amorphous silicon alloys resemble closely those of the nonalloyed material, even for large amounts of the alloying element present in the film, except for the existence of a large absorption tail at low photon energies. The refractive index, on the other hand, varies strongly with the alloyant concentration, decreasing significantly for large concentrations of the alloy element. High temperature anneal experiments were conducted to determine the structural stability with anneal of these alloyed amorphous silicon films. It was found that silicon-carbon alloys were structurally stable to temperatures of 900 C to 1000 C, depending on the carbon concentration. Dissert. Abstr.

N81-20913 North Dakota State Univ., Fargo.
LASER SPECTROSCOPY: RARE-EARTH CRYSTALS AND CRYSTALS IN SOLUTION Ph.D. Thesis
John Gregory Daly 1980 234 p
Avail: Univ. Microfilms Order No. 8105177

Two lasers, a molecular nitrogen (337.1 nm) and a dye laser, were designed and constructed for operation from 337.1 nm to 700 nm, as was a signal recovery system which includes a box car averager. Fluorescence from several rare earth crystals was recorded from 400 nm to 700 nm. These included: Eu(2+): CaF2, Tm(3+): Yb2O3, and Eu(2+): Gd2O3. Partial energy level assignment of these transitions was accomplished. Many fluorescent lifetimes were also measured. The temperature dependence of Bragg diffraction patterns in crystallized suspensions of latex polystyrene macroions was studied. It was found that the data on these crystals is consistent with a crystallization process due entirely to screened Coulomb repulsion between macroions. Dissert. Abstr.

N81-20914 Arizona Univ., Tucson.
HETERODYNE INTERFEROMETRIC AND MOIRE TEST METHODS FOR SURFACE MEASUREMENTS Ph.D. Thesis
Richard Noel Shagam 1980 211 p
Avail: Univ. Microfilms Order No. 8105310

Issues associated with the testing of optical surfaces by heterodyne interferometry are addressed. Surface height measuring methods based upon conventional interferometric techniques, including wavefront interferometry for optical surfaces and holographic and moire methods for measurement of optically diffuse surfaces are reviewed as well as the limitations to these methods. The use of polarization optics in heterodyne interferometers for both optical frequency encoding and optical frequency shifting of the two wavefronts in an interferometer is covered and a hybrid approach to the question of interferometric measurements is introduced in which conventional fringe interferograms which are properly recorded may be processed in an off-line high resolution mode. The recorded wavefront may then be reconstructed and measured using a heterodyne Mech-Zehnder interferometer and electronic phase measurement. The advantages of heterodyne reconstruction interferometry are discussed and a number of experiments to further validate the concept are proposed. Dissert. Abstr.

N81-20915 Rutgers - The State Univ., New Brunswick, N. J.
NUMERICAL STUDIES OF TRANSPORT QUANTITIES IN ONE- AND TWO-DIMENSIONAL DISORDERED SYSTEMS Ph.D. Thesis
Barbara Sue Andereck 1980 69 p
Avail: Univ. Microfilms Order No. 8104977

The question of whether or not the T = 0 d.c. conductivity of a disordered system vanishes in one and two dimensions is studied numerically by examining systems of increasing size. In one dimension transport, quantities are found to be widely

fluctuating and hence statistically unreliable. It is shown that for lengths much greater than the mean free path, the coefficient of length in the exponential describing resistance, which is the inverse localization length, is a well behaved statistical quantity satisfying the central limit theorem. It is also found that averaging resistance in one dimension results in exponential growth which is a factor of two faster than expected for a typical sample. In addition, scaling studies on a random chain rule out the possibility of extended states for disorders, as small as 0.001. Finally, improvements on a two dimensional scaling calculation illustrate the ambiguity in interpretation of numerical studies and show a trend away from a mobility edge in two dimensional disordered systems. Dissert. Abstr.

N81-20916 Rutgers - The State Univ., New Brunswick, N. J.
AN INVESTIGATION OF TKACHENKO WAVES IN ROTATING He2 Ph.D. Thesis
Claude David Andereck 1980 186 p
Avail: Univ. Microfilms Order No. 8104978

The existence of Tkachenko waves in rotating superfluid He-4 was confirmed experimentally. These displacement waves in the vortex line array that exists in a rotating superfluid were excited and detected in resonant cavities formed by a stack of closely spaced parallel plates which were attached to a torsion fiber that was mounted on a rotating cryostat capable of speeds up to 10 rad/sec and temperatures as low as .3 K. The stack was driven into low frequency torsional oscillation by a magnetic drive system and the complex amplitude response of the disk-stack/vortex-line system was then detected electrostatically. The dispersion relation, studied as a function of rotation speed, disk spacing (which fixed one component of the wavevector), and temperature, was compared with existing theories and found to be in good agreement at low temperatures. The theories predict peaks in the density of states associated with a perfect lattice of vortices; the resonant response observed were found to correspond to these peaks. Dissert. Abstr.

N81-20917 California Inst. of Tech., Pasadena.
ELECTRONIC PROPERTIES ASSOCIATED WITH DONOR IMPURITIES IN MULTIVALLEY SEMICONDUCTORS Ph.D. Thesis
Yia-Chung Chang 1981 260 p
Avail: Univ. Microfilms Order No. 8104897

The electronic properties of excitons bound to a neutral donor in multivalley Si, Ge, and GaP were investigated by studying first the effects of the valley orbit interactions on the donor states, then the energy levels of the low lying states (including fine structures produced by the interparticle interactions) for the donor bound excitons, and finally the excitation spectroscopy for the bound multiexcition complexes (BMEC) associated with donors. The intervalley scattering effect for both the kinetic and potential energy terms was considered and model Hamiltonians were developed which yield analytic expressions for the matrix elements and produce practically the same energy eigenvalues as that of the exact donor Hamiltonian. Theoretical calculation indicates that the exciton is bound to the neutral impurity for all values of sigma, the electron to hole mass ratio. Results for the energy separations between the ground state and the low lying electron excited states are in fairly good agreement with the experimental data interpreted using the shell model proposed by Kirczenow. Dissert. Abstr.

N81-20918 Pennsylvania State Univ., University Park.
ULTRASONIC ATTENUATION IN NORMAL AND SUPERCONDUCTING INDIUM Ph.D. Thesis
Michael Patrick Conley 1980 104 p
Avail: Univ. Microfilms Order No. 8105713

The dependence of ultrasonic attenuation on temperature, sonic frequency, propagation direction, and superconducting state was measured in indium single crystals using low amplitude longitudinal waves. These measurements and the experimental apparatus with which they have been obtained are described. These data indicate that, in addition to the usual electronic attenuation described quantitatively by the BCS theory of superconductivity (Bardeen et al., Phys. Rev. 108, 1175), there is an additional source of attenuation. This secondary attenuation is generally attributed to the interaction of sound waves and crystal dislocations within the specimen, a process which has been described most thoroughly by Granato and Lucke (J. Appl. Phys. 27,583). A comparison of the measured dislocation attenuations with those predicted by the theory of Granato and Lucke is given. This theory is shown to be inapplicable to the situation of this experiment, i.e., to indium at low temperatures. Earlier works in which similar data appear to substantiate the Granato and Lucke theory of dislocation attenuation are shown to be insufficient tests of that theory. Dissert. Abstr.

N81-20919 Michigan State Univ., East Lansing.
THE ELECTRICAL RESISTIVITY AND THE THERMOELECTRIC RATIO OF POTASSIUM AND DILUTE POTASSIUM RUBIDIUM ALLOYS BELOW 1 K Ph.D. Thesis
Chi-Wai Lee 1980 205 p
Avail: Univ. Microfilms Order No. 8106401

The electrical resistivity of K and dilute K-Rb alloy was measured with a high precision technique (0.1 ppm) along with the thermoelectric ratio of the same specimens over the temperature range from 4.2 K to 0.07 K. Measurements were carried out on free hanging, polycrystalline specimens with emphasis on data below 1 K, especially for the resistivity. Resistivity data above 1 K are comparable to previously published results by others. Below 1 K, the resistivity due to electron-photon scattering becomes at least three orders of magnitude smaller than the total temperature dependent resistivity, therefore the results are not affected by the phonon effect. For the pure K, one 1.5 mm diameter sample and three 3 mm diameter samples were measured. For the K-Rb alloys, five 3 mm diameter samples of nominal atomic concentrations 2.24%, 0.83%, 0.32%, 0.13% and 0.05% were measured. The measurements of the thermoelectric ratio allowed unambiguous separation of the diffusion component, the normal phonon drag component and the umklapp phonon drag component. Dissert. Abstr.

N81-20920 Iowa State Univ. of Science and Technology, Ames.
THEORY OF FLUX-FLOW VOLTAGE NOISE IN TYPE-2 SUPERCONDUCTORS Ph.D. Thesis
Peter Shuk-Yu. Li 1980 127 p
Avail: Univ. Microfilms Order No. 8106024

A theory for the flux-flow voltage noise in a type-II superconductor in the mixed state is developed. The interactions between the vortices are taken into account via a wavevector-dependent interaction matrix. Applied to Johnson noise in a film without flux flow for a special measuring circuit, the theory predicts a suppression of the power spectrum at low frequencies. For flux-flow noise produced when a perfect vortex lattice moves in a superconducting foil or film containing a random array of independent pinning centers, the theory gives two contributions to the power spectrum: one from transverse velocity fluctuations, which has a characteristic frequency determined by the characteristic frequency of the power spectrum of the elementary pinning force; the other from longitudinal density fluctuations, which may have a characteristic frequency determined by the elastic constants and the geometry of the measuring circuit. Both of these frequencies are much higher than experimentally observed values. Dissert. Abstr.

N81-20921 Connecticut Univ., Storrs.
A HEAT PULSE STUDY OF SUPERCONDUCTING LEAD/INDIUM ALLOYS Ph.D. Thesis
Richard Henry McMaster 1981 129 p
Avail: Univ. Microfilms Order No. 8106690

The thermal transport properties of dilute solutions of indium in lead from 1.4 K to 4.2 K were investigated. The measured temperature profiles resulting from the arrival of a heat pulse at a sensitive bolometer were fit to the solution of the standard diffusion equation to determine the thermal diffusivity. The data were combined with specific heat data measured elsewhere to calculate the thermal conductivity of the alloys in their superconducting state. They were further reduced to yield the lattice thermal conductivity. Analysis was performed on these data to determine the relative strengths of four phonon scattering mechanisms, dislocations, boundaries, point defects and electrons. In no case was a transition from diffusive flow to ballistic flow observed. The effect of the point defects could not be determined from the experimental data because the other mechanisms were much stronger. The electron phonon parameter was observed to

increase with increasing solute content, opposite to what could be expected. Dissert. Abstr.

N81-20922 Cornell Univ., Ithaca, N. Y.
A SEARCH FOR THE ORIGIN OF LOW TEMPERATURE ANOMALIES IN GLASSES Ph.D. Thesis
Arup Kumar Raychaudhuri 1980 240 p
Avail: Univ. Microfilms Order No. 8102902

In an attempt to understand the nature of the low frequency excitations common to all glasses, the low temperature specific heat and thermal conductivity were studied in intentionally doped ionic glasses, in neutron irradiated silica, in glasses subjected to high electric fields, and in noncrystalline superconductors near the superconducting transition temperature. It was found through controlled doping of nitrate glass with various molecular species, that tunneling by individual molecular species is not a very likely event in glasses and that a a change in specific heat arises when such bulk thermodynamic properties like the glass transition temperature have been changed. A scaling of the excess specific heat with the reciprocal of the glass transition temperature was observed. The significance of these two experimental findings is discussed in the light of some thermodynamic aspects of the glass transition. In superconducting noncrystalline alloys it is shown that the electrons can act as scattering centers for phonons and the scattering can be explained by theories developed for highly disordered crystalline alloys. Dissert. Abstr.

N81-20923 Pennsylvania State Univ., University Park.
THE ROLE OF POSITIONAL DISORDER IN FERROELECTRIC RELAXORS Ph.D. Thesis
Nava Setter 1980 140 p
Avail: Univ. Microfilms Order No. 8105806

A definitive proof of the existence and the role of disorder and associated compositional heterogeneity in determining the diffuse transition is given. Lead scandium tantalate single crystals and ceramic samples were prepared. Properties associated with the ferroelectric transition were measured. The dielectric and the thermal properties of the highly ordered samples showed a normal ferroelectric behavior typical for a first order ferroelectric transistion like a sharp peak of the dielectric constant at a well defined transition temperature, a sharp change of the spontaneous polarization, and a sharp peak in the specific heat at the transition. Upon decreasing the B-site order the transition became gradually diffused and the disordered material showed a typical ferroelectric relaxor behavior. The peak of the dielectric constant was rounded and shifted to higher temperatures upon increasing the frequency in the audio range. The development of the spontaneous polarization was slow and there was no measurable peak in the specific heat at the transition. Dissert. Abstr.

N81-20924 Wisconsin Univ. - Madison.
STRUCTURAL AND THERMODYNAMIC PROPERTIES OF XENON, KRYPTON, AND ARGON ADSORBED ON SILVER (111) Ph.D. Thesis
John Unguris 1980 166 p
Avail: Univ. Microfilms Order No. 8025856

Precise structural and thermodynamic studies of Xe, Kr, and Ar adsorbed on Ag(111) were made using low-energy electron diffraction. Monolayer lattice constants were measured as a function of temperature between 5 and 90 K for Xe, between 5 and 65 K for Kr, and between 32 and 46 K for Ar. Effective equilibrium experiments are done using a directed gas beam and cryopumping. With decreasing temperature at fixed gas flux one observes the sequential adsorption of 2D gas, monolayer, bilayer and bulk films. The effective pressure of the impinging gas at the sample is determined from the known bulk vapor pressure thus bypassing absolute pressure measurement. Phase diagrams, thermal expansion coefficients at equilibrium and zero pressure, latent heats of monolayer and bilayer condensation, isosteric heats of adsorption for the 2D gas and the 2D solid, and the lateral compressibility of the monolayer are determined. Dissert. Abstr.

N81-20925 Pennsylvania State Univ., University Park.
A STRONG COUPLED ELECTRON-ACOUSTIC PHONON SYSTEM IN ONE DIMENSION Ph.D. Thesis
Eric William Young 1980 125 p
Avail: Univ. Microfilms Order No. 8105823

A system comprised of an electron interacting with acoustic phonons via the deformation potential in one dimension is studied. A variational estimate of the energy is made for two different trial states, one of which is a momentum eigenstate. The expected value of the Hamiltonian in this eigenstate gives an upper bound to the energy. The energy-momentum relation for low momentum is presented and from this relation the effective mass is identified. An adiabatic perturbation theory is developed in which an effective-phonon Hamiltonian is generated and determined by the solution of an iterative equation. Modified phonon modes are obtained which represent excitations of the deformed lattice. One of the modes is a translation which is interpreted as a polaron, moving through the lattice. The effective mass, in addition to position and momentum operators, of the polaron is determined. The density of modified phonon modes is obtained by a Green's function method and the shift from the constant unperturbed density is computed. Interpretation of the shift is facilitated by the introduction of a phase function. The behavior of the phase function clearly demonstrates the presence of a bound state, the polaron, and a resonance. Dissert. Abstr.

N81-20926 Rutgers - The State Univ., New Brunswick, N. J.
TEMPERATURE DEPENDENCES OF HYPERFINE FIELDS AT SP-IMPURITIES IN FCC-COBALT STUDIED BY NUCLEAR SPIN PRECESSION FOLLOWING HEAVY-ION REACTIONS Ph.D. Thesis
Masayoshi Senba 1980 212 p
Avail: Univ. Microfilms Order No. 8105048

Temperature dependences of magnetic hyperfine fields at Ga, Ge, and As nuclei were measured in face centered cubic Co(fcc-Co) and in body centered cubic Fe(bcc-Fe) in the range from 80 to 1300 K. The fcc-phase was stabilized below the cobalt hcp-fcc phase transition temperature of 690 K by using sponge Co. The hyperfine fields were measured using the time differential perturbed angular distribution (TDPAD) technique after recoil-implantation of suitable isomeric probe nuclei excited by a pulsed heavy ion beam. The object of these measurements was to compare the temperature dependences of the hyperfine fields in these cubic hosts with results obtained in hexagonal close packed Co(hcp-Co), in which giant temperature anomalies were previously reported. Using the same in-beam TDPAD technique, temperature dependences of the fields at Sn and Cd in Co were also measured. Dissert. Abstr.

N81-20927 Cornell Univ., Ithaca, N. Y.
FLUXOID PINNING BY PLANAR DEFECTS IN Pb-Bi ALLOY FILMS Ph.D. Thesis
Wilson Earl Yetter 1980 368 p
Avail: Univ. Microfilms Order No. 8102897

The interaction of crystal defects with the boundaries (flux pinning) due to (1) grain boundaries; (2) composition profiles associated with grain boundaries; and (3) thin antiferromagnetic layers was investigated in Pb-Bi alloy films. The proportional to grain boundary area. A theoretical model was derived for the elementary interaction force between an isolated grain boundary and the full line lattice (FLL) based on: (1) strong electron scattering from the boundary itself; (2) a simple geometrical derivation of the electron mean free path (1) as a function of distance from the boundary; (3) a treatment of the change in FLL energy due to scattering as a small perturbation; and (4) a rigid FLL. The predictions for intrinsic grain boundaries are in substantial agreement with both the Pb-Bi data and the Q(gb) values extracted from literature data on Nb:Pb-in, and Nb3Sn. Dissert. Abstr.

N81-20928 Cornell Univ., Ithaca, N. Y.
GROWTH, CHARACTERIZATION, AND APPLICATIONS OF GALLIUM ARSENIDE AND GERMANIUM LAYERS GROWN BY MOLECULAR BEAM EPITAXY Ph.D. Thesis
Richard Alan Stall 1980 185 p
Avail: Univ. Microfilms Order No. 8102906

Molecular Beam Epitaxy (MBE) is important for producing layered structures for semiconductor devices. Studies of the growth of GaAs and Ge films by MBE are summarized. Deep levels in semiconductors affect the performance of microwave, optical, and photovoltaic devices. The techniques of Deep Level Transient Spectroscopy (DLTS) and optical DLTS were used to study the traps in GaAs grown by MBE. The conventional alloyed

ohmic contact to n-GaAs has poor morphology and elevated temperature stability. Non-alloyed contact technologies which hold promise of improved thermal stability and morphology were studied. Techniques for the growth of heavily doped GaAs layers were developed for the nonalloyed contact work. Dissert. Abstr.

N81-20929 Pennsylvania State Univ., University Park.
SUPERSTRUCTURE PHONONS AND THEIR CHARACTERIZATION BY RAMAN SPECTROSCOPY Ph.D. Thesis
Hong Lee Park 1980 131 p
Avail: Univ. Microfilms Order No. 8105783

The folded zone scheme was used to analyze the spectra of superstructures in terms of the phonons of the parent structure. The folded zone concept was tested by applying it to a series of compounds with the chalcopyrite structure. It was shown that Raman bands in the chalcopyrite structure could be attributed to zone boundary phonons from the X and W points at the surface of the large zone. Several force constant models were tested and it was shown that zone-center phonons of the large zone can be interpreted by a single-force-constant model whereas a two-force-constant model is needed for zone boundary phonons. The spectra of ZnGa2S4, and of the trirutile structure compounds MgTa2O6, CoTa2O6 and NiTa2O6 are discussed. Unlike ZnGa2S4 where there is an ordered vacancy which becomes disordered at high temperature, the Raman spectra of the trirutile compounds could be assigned exactly. It was found that the dispersion curves for the ordered trirutile structures are very similar to the dispersion curves for TiO2 and related rutile structure compounds. Dissert. Abstr.

N81-20930 Duke Univ., Durham, N. C.
ATTENUATION OF ZERO SOUND IN LIQUID He(3)-A Ph.D. Thesis
Dennis Reagan Pape 1980 185 p
Avail: Univ. Microfilms Order No. 8105072

A microscopic kinetic theory, describing collision-broadened attenuation of zero sound in the A phase of liquid He(3), is extended to include magnetic field effects. Attenuation peaks in both the A sub 1 phase (corresponding to one paired spin population) and the A phase (the phase below the A sub 2 transition corresponding to both paired spin populations) are predicted. This model is compared to high field zero sound attenuation measurements. Discrepancies are found in peak width, height, and location in temperature. Possible explanations for these discrepancies are considered. An apparatus designed to investigate further zero sound attenuation in He(3)-A at high magnetic fields is described. Failure to observe sound propagation over an extended period of time with this apparatus is believed to be related to solid formation in the He(3) sample space. The possible causes of this solid formation are investigated.
Dissert. Abstr.

N81-20931# Stanford Univ., Calif. Center for Materials Research.
A FEASIBILITY STUDY ON THE GROWTH OF BULK GaN SINGLE CRYSTALS
W. A. Tiller, R. S. Feigelson, and D. Elwell Jul. 1980 64 p refs
(Contract N00019-79-C-0327)
(AD-A095567; SU-CMR-80-13) Avail: NTIS HC A08/MF A01 CSCL 20/2

This report describes studies of the growth of GaN by the reaction between gallium and ammonia, in the presence of a carrier gas, usually hydrogen. Experiments on the growth of GaN in a horizontal chamber have been modestly successful in that they have shown that crystals over 2.5 mm long can be grown in 10 days. These experiments have identified the temperature and ammonia partial pressure conditions for relatively stable growth and have yielded useful insights into the growth process. Attempts to grow GaN by a vertical gradient transport technique and by the use of gallium/tin alloys have been much less successful. A theoretical model which explains most of the data pertaining to the growth of GaN by this method is included. Finally, recommendations are presented for further study, including suggestions of methods for growing large crystals which should be tried as a continuation to this study. It should be emphasized that this was a short-term feasibility study so that long-term planning based on a detailed understanding of the system was not possible. The approach used was pragmatic and the numerical data was gathered as expeditiously as possible. GRA

N81-20932# Stanford Univ., Calif. Center for Materials Research.
A FEASIBILITY STUDY ON THE GROWTH OF BULK GaN SINGLE CRYSTALS Quarterly Report
W. A. Tiller, R. S. Feigelson, and D. Elwell Jan. 1980 9 p refs
(Contract N00019-79-C-0327)
(AD-A095553; CMR-80-1; QR-2) Avail: NTIS HC A02/MF A01 CSCL 20/2

In the previous report, a breakthrough was reported in attempts to prepare large crystals of GaN, in that the maximum crystal size had been increased for the first time above 1 mm. The emphasis in the previous quarter has been to obtain an improved understanding of the factors leading to this improvement and so to determine the conditions necessary for the next advance. Experimental work has been concentrated on the horizontal crucible method which has shown the greatest promise to date. In order to study in more detail the reaction between ammonia and liquid gallium, a series of experiments has been performed in which ten samples were located in separate recesses in a compartmented quartz crucible. The overall length of the crucible was 15 cm, as in the case of a single vitreous carbon boat, and the compartmented tube was located in the same temperature gradient as in previous experiments with the carbon boat (1010-825 C). The ratio of ammonia to hydrogen flows was 0.002, as in the experiments of Logan and Thrumond, and the hydrogen flow rate was about 225 cu cm/min. The reaction proceeded for 12 days in each case. Prior to crystal growth, the furnace was purged with hydrogen for 12 hours at room temperature, followed by 24 hours at about 1200 C. GRA

N81-20933# California Inst. of Tech., Pasadena.
THE APPLICATION OF NUCLEAR TECHNIQUES TO SOLID STATE DEVICES Final Technical Report, 1 Jan. 1975 - 31 Aug. 1980
James W. Mayer and Marc-A. Nicolet 15 Dec. 1980 57 p refs
(Contract N00014-75-C-0564)
(AD-A095251) Avail: NTIS HC A04/MF A01 CSCL 20/2

This project formally pursued two distinct topics: solid-phase epitaxial growth (SPEG) and reaction of thin metal films with silicon substrates. Although the two topics are treated separately, in the summary of scientific results, in fact, however, the two topics were always closely related. Research on both subjects was frequently performed by the same individual, so that ideas and experiments on each topic were constantly intertwined.GRA

N81-20934# Northwestern Univ., Evanston, Ill.
NONLINEAR OPTICAL EFFECTS IN LIQUID CRYSTALS Final Report
George K. Wong 10 Dec. 1980 115 p refs
(Grant DAAG29-77-G-0009)
(AD-A095368; ARO-14280.4-P) Avail: NTIS HC A06/MF A01 CSCL 07/4

A d.c. field induced optical second-harmonic generation in nematic and cholesteric liquid crystals is investigated. In addition, flexo-electric induces second-harmonic generation in nematic MBBA is studied. The experiments involve the detection of optical radiation at second-harmonic frequency when aligned thin film liquid crystals samples are irradiated with laser beam at the fundamental frequency. The laser used in a Q-switched Nd-YAG laser. Sample alignment is achieved either with rubbing technique or by coating glass spacers with 100 A thick of Si2. Experiments on nematic liquid crystals show that the temperature dependence of nematic order parameters can be obtained from the measurement of d.c. induced second-harmonic generation. It is also demonstrated that flexoelectric effect can give rise to second-harmonic generation in nematic liquid crystal and the birefringence of nematic crystal can be used to achieve phase-matching. In the cholesteric liquid crystal, it is demonstrated that the lattice momentum associated with the one dimensional periodicity of cholesteric structure can be used to achieve phase-matching. Comparison of the measured temperature dependence of nematic order parameters with the predictions of the existing statistical theories of nematic ordering indicates that these theories are not quantitatively reliable. The phase-

matchability of liquid crystals shows that these media may be useful as practical optical harmonic generators. GRA

N81-20935# Pennsylvania Univ., Philadelphia. School of Electrical Engineering.
EXPERIMENTAL AND THEORETICAL STUDIES OF DONOR-TYPE GRAPHITE INTERCALATED COMPOUNDS Final Report, Jul. 1977 - Sep. 1980
John E. Fischer and S. Rabii 20 Dec. 1980 59 p refs
(Contract DAAG29-77-C-0040)
(AD-A095282; ARO-14625.14-P) Avail: NTIS HC A04/MF A01 CSCL 07/4

Graphite intercalation compounds are a large family of quasi two dimensional synthetic metals. Fundamental interest centers on their unusual crystal structures and their effects on electronic properties. Practical applications are envisaged as lightweight conductors of electricity. The goals of this program are to understand the electronic structure of donor-type compounds, with a view toward obtaining detailed correlations between chemical and physical variables. Emphasis is placed on the one-electron spectrum, transport and optical properties and charge distributions. Synthetic methods are developed to provide high-quality specimens for a variety of physical measurements. Band theoretical techniques are applied to develop models for the electronic structure. Iteration between theory and experiment leads to more sophisticated models. GRA

N81-20936# Los Alamos Scientific Lab., N. Mex.
STUDY OF THE EFFECTIVENESS OF SELECTIVE ABSORBER COATINGS AND PHASE CHANGE MATERIALS IN PASSIVE SOLAR SPACE HEATING
W. O. Wray, I. C. Hyde, and L. E. Bourdeau (Lab. CRNR-PIRDES dEnergie Solaire, Nice, France) 1980 5 p refs Presented at the 1980 Passive and Hybrid Solar Energy Program Update Meeting, Washington, D.C., 21-24 Sep. 1980
(Contract W-7405-eng-36)
(LA-UR-80-2930; CONF-800972-6) Avail: NTIS HC A02/MF A01

The performance of selective absorber coatings in passive solar heating systems is assessed. The relative performance of thermal storage wall buildings when equipped either with a selective absorber coating or movable night instalation is studied. The advantages a phase change thermal storage wall might have over a conventional system that employs either masonary or water as the thermal storage medium are determined. Phase change material walls were tested with and without a diatomaceous Earth thickening agent that suppresses convection and in both vented and unvented configurations. Results are presented and discussed. DOE

N81-20937# Sandia Labs., Albuquerque, N. Mex. Advanced Development Div.
TRANSIENT ANALYSIS OF VIBRATIONS IN NONIDEAL MULTILAYERED PIEZOELECTRIC DEVICES
Marion L. Hodgdon Nov. 1980 26 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-1909) Avail: NTIS HC A03/MF A01

A numerical method of solving the equations involved in the transient vibration analysis of nonideal multilayered piezoelectric devices is presented. The use of the computer code WONDY 4 in obtaining the solution, a numerical example, and experimental data is described. In addition, a method is included for approximating the values of creep or relaxation functions from steady state attenuation data. DOE

N81-20938# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
MICROSTRUCTURE AND PROPERTIES OF STEP AGED RARE EARTH ALLOY MAGNETS
Raja K. Mishra, G. Thomas, T. Yoneyama, A. Fukuno, and T. Ojima Nov. 1980 6 p refs Presented at the 26th Ann. Conf. on Magnetism and Magnetic Metals, Dallas, 11-14 Nov. 1980 Prepared in cooperation with TDK Electronics Co. Ltd., Ichikawa, Japan
(Contract W-7405-eng-48)
(LBL-11680; CONF-801134-13) Avail: NTIS HC A02/MF A01

Alloys with compositions Co-25.5 wt/o Sm-8 w/o Cu-15 w/o Fe-3 w/o Zr and Co-Sm-Cu-Fe-1.5 w/o Zr were step aged to produce magnets with coercive force (iHc) in the range of 10 to 25kOe. The high coercive force magnets are typically aged at 800 to 850(0) C for 10 to 30 hours following the solution treatment at 1150(0)C. Subsequently, these are step aged to produce materials with high coercivity. The microstructure in all these alloys has a 2 phase cellular morphology with 2:17 phase surrounded by a 1:5 boundary phase. The long aging treatments at 800 to 850(0)C lead to coarsening of the two phase structure. The subsequent step-aging does not change the morphology, but only changes the chemical composition of the two phases. Best properties are obtained in materials with a coherent microstructure of optimum boundary phase thickness and optimum chemical composition. The highest values of iHc obtained so far are approx. 26kOe and approx. 16 kOe for the 3 percent Zr and 1.5 percent Zr alloys respectively. The best hard magnetic properties of (BH) max = 33 MGOe and iHc = 13kOe are for a 25 percent Sm-20 percent Fe-4 Cu-2 percent Zr alloy. DOE

N81-20939# Battelle Pacific Northwest Labs., Richland, Wash.
ION IMPLANTATION OF KRYPTON IN SPUTTER-DEPOSITED METAL MATRICES
Garth L. Tingey, E. D. McClanahan, and John F. Nesbitt Jun. 1980 19 p refs Presented at the DOE Meeting on Ion Implantation and Zeloyte Encapsulation Technol. for Immobilization of Krypton-85, La Jolla, Calif., 17-19 Jun. 1980
(Contract DE-AC06-76RL-01830)
(PNL-SA-8661; CONF-8006150-1) Avail: NTIS HC A02/MF A01

Krypton 85 was successfully stored in a metal matrix by bombarding the metal surface with krypton ions while the metal was being deposited by sputtering. The krypton is thus incorporated into the metal in concentrations approaching 200 cm(3) of Kr(STP)cm(3) of deposit. Cost estimates of a facility to perform this work are given. DOE

N81-20940# AEG-Telefunken, Heilbronn (West Germany). Geschaeftsbereich Halbleiter.
MATERIALS FOR OPTO-ELECTRONIC DEVICES Final Report
Klaus Gillessen and Wolfgang Gramann Bonn Bundesministerium fuer Forschung und Technologie Jul. 1980 52 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-026; ISSN-0340-7608) Avail: NTIS HC A04/MF A01

Developments in fabrication processes to produce doped GaAs and GaP materials for light emitting diodes are described. The choice of materials and fabrication process is greatly influenced by competitivity considerations. It is found that the synthesis solute diffusion method cannot be used to competitively produce either nitrogen, sulfur, or tellurium doped single GaP crystals or In(1-x) Ga(x)P. Futhermore, as AgGaS2 cannot be doped by simple means, it is therefore not suitable for producing blue light. Fast emitter diodes can easily be produced with the liquid phase epitaxy of GaAs:Ge. The vapor phase epitaxy of GaAs(1-x) P(x) can be successfully carried out on an industrial scale. Author (ESA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N81-20941 Iowa State Univ. of Science and Technology, Ames.
ACTION ANGLE VARIABLES IN CLASSICAL AND QUANTUM MECHANICS Ph.D. Thesis
Michael John Padgett 1980 155 p
Avail: Univ. Microfilms Order No. 8106041

The quantum analogue of classical Hamiltonian-Jacobi theory

is constructed by inventing quantum action angle variables. Quantum action angle variables are defined using two methods. The first method uses the classical transformation equations for a system to deduce the corresponding quantum equations. Conditions for verifying that correct quantum transformation equations have been found are listed, and general properties of quantum action angle variables, J and W, the wavefunction, <W'/J'>, and the eigenvalues of J are studied. This method is applied to the rotor, angular problem and one, two and three dimensional harmonic oscillators. The second method, which is completely general, defines a quantum momentum eigenvalue function, p(q', E'), in order to define the eigenvalue, J'(E)', of the quantum action variable, J, and to establish a quantum transformation theory analogous to the classical theory. The rotor, harmonic oscillator and coulomb problems are treated using this method. It is found that this second method allows one to find the energy eigenvalues of a general system without solving Schrodinger's equation for the wavefunction. Dissert. Abstr.

N81-20942# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

SELF-CONSISTENT MANY BODY THEORY FOR THE STANDARD BASIS OPERATOR GREEN'S FUNCTIONS

R. Micnas Dec. 1980 50 p refs Submitted for publication
(INPE-1962-RPE/275) Avail: NTIS HC A03/MF A01

A self consistent many body theory is proposed for the standard basis operator Green's functions. An exact Dyson type matrix equation is obtained for the interacting many level systems. A zeroth order approximation, which neglects all the damping effects, is investigated in detail for the anisotropic Heisenberg model, the isotropic quadropolar system, and the Hubbard model. In case of the anisotropic Heisenberg ferromagnet with both exchange and single ion anisotropy the low temperature renormalization of the spin waves for the uniaxial ordering agrees with the Block-Dyson thoery. For the spin 1 easy plane ferromagnet, the critical parameters for the phase transition at zero temperature are determined and compared with other theories. The elementary excitation spectrum of the spin 1 isotropic quadrupolar system is calculated and compared with the random phase approximation and Callen's like decoupling schemes. Finally, the theory is applied to the study of the single particle excitation spectrum of the Hubbard model. M.G.

N81-20943# Argonne National Lab., Ill. Chemical Engineering Div.

CALCULATION OF THE THERMODYNAMIC PROPERTIES OF FUEL-VAPOR SPECIES FROM SPECTROSCOPIC DATA

David W. Green Sep. 1980 84 p refs
(Contract W-31-109-eng-38)
(ANL-CEN-RSD-80-2) Avail: NTIS HC A05/MF A01

Measured spectroscopic data, estimated molecular parameters, and a density-of-states model for electronic structure were used to calculate thermodynamic functions for gaseous ThO, ThO2, UO, UO2, UO3, PuO, and PuO2. Various methods for estimating parameters were considered and numerically evaluated. The sensitivity of the calculated thermodynamic functions to molecular parameters was examined quantitatively. Values of the standard enthalpies of formation at 298.15(0)K were derived from the best available (DELTA)G(0)/sub f/ equations and the calculated thermodynamic functions. Estimates of the uncertainties were made for measured and estimated data as well as for various mathematical and physical approximations. Tables of the thermodynamic functions to 6000(0)K are recommended for gaseous thorium, uranium, and plutonium oxides. DOE

N81-20944# Loughborough Univ. of Technology (England). Dept. of Mathematics

A NEWMAN-PENROSE TYPE FORMALISM FOR SPACE-TIMES WITH TORSION. PART 2: EXACT PLANE WAVE SOLUTIONS

S. Jogia and J. B. Griffiths Sep. 1979 17 p refs
(Math-Res-143-Pt-2) Avail: NTIS HC A02/MF A01

A generalized spin-coefficient approach that can be used to obtain an exact solution for space-times with torsion is demonstrated. It is assumed that the contortion tensor is either a trivector or has a semisymmetric form. Then for null fields, with appropriate conditions on the curvature tensor, the new set of contortion identities imply that the principal null congruence has plane parallel rays, and exact plane wave solutions are obtained. Author (ESA)

N81-20945# Loughborough Univ. of Technology (England). Dept. of Mathematics.

GHOST NEUTRINOS IN EINSTEIN-CARTAN THEORY

J. B. Griffiths Dec. 1979 5 p refs
(Math-Res-146) Avail: NTIS HC A02/MF A01

It is shown that ghost neutrino fields can occur in Einstein-Cartan theory as well as in general relativity, contrary to an earlier result of Letelier. A proof that the conditions for ghost neutrinos used by Letelier were unnecessarily strong, and that in Einstein-Cartan theory exact solutions exist for which the canonical energy-momentum tensor vanishes while the neutrino current vector remains non-zero, is given. An exact solution is presented in terms of a Newman-Penrose formalism. Author (ESA)

N81-20946# Loughborough Univ. of Technology (England). Dept. of Mathematics.

A NEWMAN-PENROSE TYPE FORMALISM FOR SPACE-TIMES WITH TORSION. PART 3: NEUTRINO FIELDS IN EINSTEIN-CARTAN THEORY

J. B. Griffiths Mar. 1980 19 p refs
(Math-Res-147-Pt-3) Avail: NTIS HC A02/MF A01

The spin-coefficient formalism is applied to classical neutrino fields in Einstein-Cartan theory. It is shown that the neutrino current vector is tangent to an expansion-free null geodesic congruence with constant and equal twist and shear, which vanish if and only if the congruence is a repeated principal null congruence of the gravitational field. All exact solutions for the case of pure radiation fields are obtained, and it is shown that the only possible ghost solutions have a plane wave metric. Author (ESA)

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N81-20947*# National Aeronautics and Space Administration, Washington, D. C. Academic Affairs Div.

LIMITLESS HORIZONS. CAREERS IN AEROSPACE

Mary H. Lewis (Hampton City Schools, Virginia) 1980 155 p refs
(NASA-EP-171; NASA-TM-82320) Avail: NTIS HC A08/MF A01 CSCL 05I

A manual is presented for use by counselors in career guidance programs. Pertinent information is provided on choices open in aerospace sciences, engineering, and technology. Accredited institutions awarding degrees in pertinent areas are listed as well as additional sources of aerospace career information. NASA's role and fields of interest are emphasized. A.R.H.

N81-20975*# National Aeronautics and Space Administration, Washington, D. C.

THE UNIVERSITIES: ALLIES AND RIVALS TO NASA

In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 223-242 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 05A

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N81-20948# Messerschmidt-Boelkow G.m.b.H., Munich (West Germany).

MANAGEMENT ADVANTAGES OF THE STANDARD WORK BREAKDOWN STRUCTURE PROPOSED BY THE EUROPEAN SPACE AGENCY FOR SPACE SATELLITE PROJECTS M.A. Thesis - Pacific States Univ.

Bernd-Joachim Madauss 17 Jul. 1980 126 p refs
Avail: NTIS HC A07/MF A01

The advantages and disadvantages of a selected work breakdown structure (WBS) configuration were tested on the basis of realistic conditions then compared with two other concepts based on an evaluation of 44 WBS concepts. Each WBS configuration was rated on six management effectiveness criteria (MEC) which represented all the known and applied fields of modern project management methodology. The six MEC sub-questions established were further broken down into 58 detailed questions as a basis on which the test actually was performed. Author (ESA)

N81-20969*# National Aeronautics and Space Administration, Washington, D. C.
RESPONSE TO SPUTNIK: THE CREATION OF NASA
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 87-99 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 05A

N81-20970*# National Aeronautics and Space Administration, Washington, D. C.
NASA GETS UNDER WAY
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 100-115 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 05A

N81-20971*# National Aeronautics and Space Administration, Washington, D. C.
EXTERNAL RELATIONS
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 116-132 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 05A

N81-20976*# National Aeronautics and Space Administration, Washington, D. C.
PROGRAMS, PROJECTS, AND HEADACHES
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 243-257 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 05A

N81-20977*# National Aeronautics and Space Administration, Washington, D. C.
JET PROPULSION LABORATORY: OUTSIDER OR INSIDER?
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 258-273 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 05A

N81-20979*# National Aeronautics and Space Administration, Washington, D. C.
LEADERSHIP AND CHANGING TIMES
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 283-295 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 05A

N81-20980*# National Aeronautics and Space Administration, Washington, D. C.
INTERNATIONAL TIES
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 299-318 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 05A

N81-20983*# National Aeronautics and Space Administration, Washington, D. C.
OBJECTIVES, PLANS, AND BUDGETS
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 373-392 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 05A

N81-20984*# National Aeronautics and Space Administration, Washington, D. C.
REVIEW AND ASSESSMENT
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 393-411 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 05A

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N81-20949*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SCIENTIFIC AND TECHNICAL INFORMATION OUTPUT OF THE LANGLEY RESEARCH CENTER FOR CALENDAR YEAR 1980
Feb. 1981 245 p
(NASA-TM-81950) Avail: NTIS HC A11/MF A01 CSCL 05B

This document is a compilation of the scientific and technical information that the Langley Research Center has produced during the calendar year 1980. Approximately 1400 citations are given. Formal reports, quick-release technical memorandums, contractor reports, journal articles, meeting/conference papers, computer programs, tech briefs, patents, and unpublished research are included. J.M.S.

N81-20950# Pattern Analysis and Recognition Corp., Rome, N. Y.
ADVANCED QUERY FACILITY Final Technical Report, 15 Jun. 1979 - 31 Oct. 1980
Clinton P. Mah Nov. 1980 70 p refs
(Contract F30602-79-C-0174; AF Proj. 4594)
(AD-A095717; PAR-80-53; RADC-TR-80-356) Avail: NTIS HC A04/MF A01 CSCL 09/2

The report documents cumulative results of a 15 month R and D effort consisting in development of an adaptive query facility (AQF) for interactive exploitation of differently formatted target databases. AQF is a software package intended for experimentation and testing in operational environment. It provides a flexible and transparent on-line user access to target databases of arbitrary structure, and offers a variety of services including natural language query processing, relational modeling of target data structures, correlation of data from various databases, and generation of informative report displays for users lacking experience with computers. AQF operates through an intermediate relational data model, thus insuring independence of the organization of target databases and their respective database management systems. Software package consists of a natural language query processor; a general target database access module; an automatic report generator; grammar and dictionary entry software; database mapping table software; diagnostic and validation tools, and a basic grammar for English query language. The package is written in FORTRAN for portability and runnable on small scale processors like DEC PDP 11/45 under RSX-11M. AQF is also implementable on a micro-processor. Some commercially available CRT terminals can accommodate a 16 bit DEC LSI-11/03 micro-processor, up to 128K bytes of static MOS memory, serial interface, and a dual floppy-disk drive at a total price under $12,000. RSX-11M can run on such a micro-processor system, thus insuring immediate implementability of AQF in the present FORTRAN version on the system. GRA

N81-20951# Yale Univ., New Haven, Conn. Dept. of Computer Science.
MEMORY, MEANING AND SYNTAX
Roger C. Schank and Lawrence Birnbaum Nov. 1980 73 p refs
(Contract N00014-75-C-1111; Grant NSF IST-79-18463)
(AD-A095451; TR-189) Avail: NTIS HC A04/MF A01 CSCL 05/7

This paper explores the role of syntax in computational theories of natural language. We discuss the integrated processing hypothesis, which contends that meaning and world knowledge play a crucial part in language understanding even at the earliest points in the process. The hypothesis implies that syntactic knowledge plays no privileged role in language processing. Computer models of language analysis are discussed in relation to the overall theory. GRA

N81-20952# Defense Technical Information Center, Alexandria, Va.
DEFENSE TECHNICAL INFORMATION CENTER REFERRAL DATA BANK DIRECTORY, EDITION NO. 8
Hazel T. Horton Feb. 1981 447 p
(AD-A095600; DTIC/TR-81/1) Avail: NTIS HC A19/MF A01 CSCL 05/2

This revised directory of the information sources in the DTIC Referral Data Bank consists of a compilation of computer printouts, each of which gives for a single activity detailed descriptive information on the mission, scope and services provided. Arrangement is numerical by referral number, with two indexes: director/contact and subject. A list of Department of Defense Information Analysis Centers with military sponsors is also provided. GRA

N81-20953# Sandia Labs., Albuquerque, N. Mex.
MODULAR FILE-STRUCTURED DATABASING SYSTEM
Evelyn L. Mathey and Jerry D. Stauffer 1980 11 p Presented at the ACM Mountain Reg. Conf., Denver, 15 Nov. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-2336C; CONF-801150-1) Avail: NTIS HC A02/MF A01

Computer aids for integrated circuit design require the manipulation of vast amounts of data. The SADIST-SLINK modular file-structured databasing system consists of a databasing primitive written in FORTRAN and a powerful surround program written in PASCAL. The modular approach is simple, cost-effective, and efficient. In addition to circuit library information, the database currently contains HELP and DOCUMENTATION files, as well as runstream files that provide operating data for a Design Executive Program. DOE

N81-20954# European Space Agency, Paris (France).
MATERIALS DATA RETRIEVAL AT ESTEC
J. Dauphin (ESTEC, Noordwijk, Netherlands) and P. Jollet (ESTEC, Noordwijk, Netherlands) Nov. 1978 59 p refs Supersedes ESRO-TN-120
(ESA-STM-206; ESRO-TN-120) Avail: NTIS HC A04/MF A01

A mechanized document retrieval system for space qualified materials is described. The interactive system uses the APL programming language. Materials are identified by trade name and number, manufacturer, product type and chemical nature. Volatile condensible materials properties as well as thermo-optical, offgassing, odor, and flammability properties are used to identify materials in the system. Examples of search strategies and a description of the files are given. Author (ESA)

N81-20955# National Bureau of Standards, Washington, D.C.
DATA BASES AVAILABLE AT THE NATIONAL BUREAU OF STANDARDS LIBRARY
Diane Cunningham Oct. 1980 69 p
(PB81-132870; NBSIR-80-2133) Avail: NTIS HC A04/MF A01 CSCL 05B

An alphabetical listing either by acronym or full title of the data base is presented. Additional information provides description of the data base, period of coverage, producer(s), corresponding hard copy, principal sources and vendors. A general subject and a cross reference index to the data bases is also supplied. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N81-20956*# National Aeronautics and Space Administration, Washington, D. C.
THE 1981 BUDGET OF THE GERMAN FEDERAL MINISTRY FOR RESEARCH AND TECHNOLOGY
Apr. 1981 26 p refs Transl. into ENGLISH of "Haushalt 1981" West Germany p 124-131 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76493) Avail: NTIS HC A03/MF A01 CSCL 05C

German research and technology programs for 1978-1981 are outlined and amounts of money proposed for various programs are given. A.R.H.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N81-20974*# National Aeronautics and Space Administration, Washington, D. C.
WHO DECIDES?
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 203-222 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 05D

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N81-20957# Council on Environmental Quality, Washington, D.C. Council on Environmental Quality.
GLOBAL FUTURE: TIME TO ACT. REPORT TO THE PRESIDENT ON GLOBAL RESOURCES, ENVIRONMENT AND POPULATION
Jan. 1981 264 p
Avail: NTIS HC A12/MF A01

Considered assessments and ideas for action that the United States, in concert with other nations, could take to respond vigorously to urgent global problems are presented. The effectiveness of current government programs related to long term global issues is discussed for the following areas: population; food and agriculture; renewable energy resources and conservation; tropical forests; biological diversity; coastal and marine resources; water resources; global pollution; sustainable development; and institutional changes. The creation of public awareness is considered for all aspects. A.R.H.

N81-20958*# Garrett Corp., Phoenix, Ariz. Turbine Engine Co.
ANALYTICAL DESIGN OF AN ADVANCED RADIAL TURBINE Final Report, 1 Feb. 1979 - 1 Aug. 1980
Gerald D. Large, David G. Finger, and Charles G. Linder Feb. 1981 155 p refs
(Contracts DEN3-106; DE-AI01-77CS-51040)
(NASA-CR-165170; DOE/NASA/0106-1; Rept-31-1653) Avail: NTIS HC A08/MF A01 CSCL 13F

The aerodynamic and mechanical potential of a single stage ceramic radial inflow turbine was evaluated for a high temperature single stage automotive engine. The aerodynamic analysis utilizes a turbine system optimization technique to evaluate both radial and nonradial rotor blading. Selected turbine rotor configurations were evaluated mechanically with three dimensional finite element techniques. Results indicate that exceptionally high rotor tip speeds (2300 ft/sec) and performance potential are feasible with radial bladed rotors if the projected ceramic material properties are realized. Nonradial rotors reduced tip speed requirements (at constant turbine efficiency) but resulted in a lower cumulative probability of success due to higher blade and disk stresses. R.C.T.

N81-20959# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
VERIFICATION AND PRODUCT-IMPROVED TESTS OF THE SOUTH COAST TECHNOLOGY R-1 ELECTRIC RABBIT
Edward J. Dowgiallo, Jr., Ivan R. Snellings, and William H. Blake

Nov. 1980 51 p
(Contract ED-77-A-31-1042)
(AD-A095303; MERADCOM-2314) Avail: NTIS HC A04/MF A01 CSCL 13/6

The South Coast Technology R-1 Electric is a standard VW Rabbit that has been converted to an electric vehicle. The SCT R-1 Electric was tested by the US Army Mobility Equipment Research and Development Command as part of a Department of Energy project to characterize the state of the art and to verify Manufacturer certification of the electric vehicle. The R-1 Electric performance test results are presented in this report. The SCT R-1 Electric is powered by 18 lead-acid batteries, has a separately excited moter, transistorized field chopper controller, regenerative braking, and a 4 speed manual transmission. GRA

N81-20960# Dunlap and Associates, Inc., Darien, Conn.
PASSENGER VALUE STRUCTURE MODEL: AUTOMATED GUIDEWAY TRANSIT TECHNOLOGY PROGRAM Final Report, Jan. 1977 - Jan. 1980
L. G. Richards (Virginia Univ., Charlottesville) and I. D. Jacobson (Virginia Univ., Charlottesville) Jul. 1980 203 p refs
(Contract DOT-TSC-1314)
(PB81-120875; DOT-TSC-UMTA-80-23; UMTA-MA-06-0048-79-8) Avail: NTIS HC A09/MF A01 CSCL 13L

A model of the passenger's value structure is developed which reveals the role and importance of perceived security and other system characteristics of the passenger's evaluation and use of transit systems. Included are: a literature review on perceived security; two models of perceived security; an experimental test (description) of a crime countermeasure and its effect on perceived security; a review of the results of two surveys; refinement of the models based on the results of the experiments; and a discussion highlighting findings and suggested research. Two models of perceived security were developed: one showing the effects of perceived security on transit choice and use; and the other describing the determinants of perceived security. GRA

N81-20961# International Business Services, Inc., Washington, D.C.
INTERCITY, BUS, RAIL, AND AIR SERVICE FOR RESIDENTS OF RURAL AREAS Final Report
John Wells, James Manion, Megen Connelly, Karen Johnson, Maria Kinney, and Caroline Wagner Jan. 1980 346 p
(Contract DOT-OST-80082)
(PB81-120826; DOT-P-10-80-18) Avail: NTIS HC A15/MF A01 CSCL 13B

Intercity passenger service for residents of rural areas, i.e., persons who live outside officially designated urbanized areas, is surveyed in four areas. Part 1 develops the analytical structure for the study and introduces a definitional structure designed to reduce the considerable semantic confusion surrounding the subject matter area. Parts 2, 3 and 4 examine the characteristics of bus, rail and air service, respectively, currently provided to rural residents. The bus findings were based partly upon case studies of rural areas in 10 states. The combination of bus and air service provides adequate intercity service for most rural residents, and access to this service is not a major problem. GRA

88 SPACE SCIENCES (GENERAL)

N81-20962*# National Aeronautics and Space Administration, Washington, D. C.
BEYOND THE ATMOSPHERE: EARLY YEARS OF SPACE SCIENCE
Homer E. Newell 1980 512 p refs Original contains color illustrations
(NASA-SP-4211) Avail: NTIS MF A01; SOD HC $11.00 CSCL 03C

From the rocket measurements of the upper atmosphere and Sun that began in 1946, space science gradually emerged as a new field of scientific activity. The course of the United State space program is viewed in an historical context. Major emphasis is on NASA and its programs. The funding, staffing, organization, and priorities of the space program were reviewed. For individual titles, see N81-20963 through N81-20984.

N81-20963*# National Aeronautics and Space Administration, Washington, D. C.
THE MEANING OF SPACE SCIENCE
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 3-15 ref (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 03C

The development of aerospace sciences through the first decade of NASA's existence was reviewed. Those scientific investigations made possible or significantly aided by rockets, satellites, and space probes are discussed along with the resulting space techniques that developed by way of those investigations. T.M.

N81-20964*# National Aeronautics and Space Administration, Washington, D. C.
THE CONTEXT
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 16-21 ref (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 03C

The relationships among science, technology, and applications are discussed. Special emphasis is placed on public support of space exploration and aerospace sciences in general. Examples of technological spinoffs are presented. T.M.

N81-20965*# National Aeronautics and Space Administration, Washington, D. C.
PROPHETS AND PIONEERS OF SPACEFLIGHT
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 25-32 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 03C

The development of rocket flight is discussed and its importance in the development of space exploration is emphasized. Early work in rocket design, construction, and launching was reviewed. T.M.

N81-20966*# National Aeronautics and Space Administration, Washington, D. C.
THE ROCKET AND SATELLITES RESEARCH PANEL: THE FIRST SPACE SCIENTISTS
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 33-49 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 22B

The development of rocket flight was examined with particular emphasis on its use in meteorological flight and atmospheric sounding. The growth of the research panel is described and the technological applications of the research is summarized. Important applications included: design of missiles, high-altitude craft, and space vehicles, special techniques of high-altitude navigation; study of climate; and military defense systems. T.M.

N81-20967*# National Aeronautics and Space Administration, Washington, D. C.
THE ACADEMY OF SCIENCES STAKES A CLAIM
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 50-57 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 22A

The establishment of the National Committe for the International Geophysical year is described. Post-war development of the 1950's in the areas of upper atmosphere research reviewed and included: the further development of satellites; sounding rocket research; and the launching of the Sputnik Satellites.T.M.

N81-20968*# National Aeronautics and Space Administration, Washington, D. C.
EARLY HARVEST: THE UPPER ATMOSPHERE AND COSMIC RAYS c46
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 58-84 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 04A

Achievements in space science through 1958 are summarized. Topics discussed are: the scheduling of V-2 flights; the development of newer rockets; the testing of spaceborne instruments; the seeking of financial support for space research; and the

problems of international cooperation. Special emphasis is placed on atmospheric sounding. T.M.

N81-20969*# National Aeronautics and Space Administration, Washington, D. C.
RESPONSE TO SPUTNIK: THE CREATION OF NASA c81
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 87-99 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 05A

The merger of academic, industrial, and political forces in the United States after the launching of Sputnik 1 is described. The decisions and governmental policies that lead to the formation of NASA are summarized. The question of whether NASA would be a military of civilian operation is discussed and the importance of the decision to have NASA as a civilian organization is emphasized. T.M.

N81-20970*# National Aeronautics and Space Administration, Washington, D. C.
NASA GETS UNDER WAY c81
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 100-115 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 05A

The organization, staffing, and project management of NASA was reviewed. Early projects included: sounding rocket research; explorer-class satellites; geodetic satellites; weather satellites; and communication satellites. The first recorded direct obligations to space science or related projects are presented. T.M.

N81-20971*# National Aeronautics and Space Administration, Washington, D. C.
EXTERNAL RELATIONS c81
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 116-132 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 05A

Mechanisms for a variety of external relations were developed by NASA for programs that clearly would involve more people outside NASA than in, and in which numerous other agencies would have strong interests. The relation between NASA and the Department of Defense, the Academy of Science, and the President's Science Advisory Committe are summzarized. The publication of results and technology transfer between NASA and universities and other scientific societies are discussed. T.M.

N81-20972*# National Aeronautics and Space Administration, Washington, D. C.
ROCKETS AND SPACECRAFT: SINE QUA NON OF SPACE SCIENCE c18
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 133-170 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 22B

The evolution of the national launch vehicle stable is presented along with lists of launch vehicles used in NASA programs. A partial list of spacecraft used throughout the world is also given. Scientific spacecraft costs are presented along with an historial overview of project development and funding in NASA. T.M.

N81-20973*# National Aeronautics and Space Administration, Washington, D. C.
DEEPENING PERSPECTIVE: A NEW LOOK AT THE OLD WORLD c43
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 172-200 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 08F

The development space satellites is examined with particular reference to their contributions to scientific research. The accomplishments in the fields of geodesy and the magnetosphere are reviewed in some detail. M.G.

N81-20974*# National Aeronautics and Space Administration, Washington, D. C.
WHO DECIDES? c84
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 203-222 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 05D

A historical overview is given of the relations between NASA and the scientific community as regards the responsibility of formulating the directions of space science projects. The role of the National Academy of Sciences and the development of the Space Science Board and the creation of NASA in-house advisory boards are discussed. M.G.

N81-20975*# National Aeronautics and Space Administration, Washington, D. C.
THE UNIVERSITIES: ALLIES AND RIVALS TO NASA c80
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 223-242 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 05A

NASA's association with the university is reviewed. The development of the 'sustaining university program' is traced historically along with other issues concerning grant policy. Graduate training programs, facility construction, and the development of research institutes are addressed. M.G.

N81-20976*# National Aeronautics and Space Administration, Washington, D. C.
PROGRAMS, PROJECTS, AND HEADACHES c81
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 243-257 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 05A

The role of the individual NASA space centers in the space science program is examined. The relationship between the space centers and the NASA headquarters is discussed. M.G.

N81-20977*# National Aeronautics and Space Administration, Washington, D. C.
JET PROPULSION LABORATORY: OUTSIDER OR INSIDER? c81
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 258-273 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 05A

The working relationship between NASA and the Jet Propulsion Laboratory is examined in a historical context. The problems which developed due to the facility's close university association are addressed. M.G.

N81-20978*# National Aeronautics and Space Administration, Washington, D. C.
LIFE SCIENCES: NO PLACE IN THE SUN c51
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 274-282 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 06C

The status of the life sciences within NASA is reviewed. The historical movement towards a unified life sciences program is discussed. M.G.

N81-20979*# National Aeronautics and Space Administration, Washington, D. C.
LEADERSHIP AND CHANGING TIMES c81
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 283-295 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 05A

The role of NASA's administrators in the development of a wide-ranging program of Earth and space sciences is examined. Emphasis is placed on the manned space flight projects. M.G.

N81-20980*# National Aeronautics and Space Administration, Washington, D. C.
INTERNATIONAL TIES c81
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 299-318 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 05A

A historical overview of NASA's participation in international activities in space science is given. The Ariel, Alouette, Isis, and San Marco satellite programs are addressed along with sounding rocket and ground based projects. Relations and cooperation with the Soviet Union are also discussed. M.G.

N81-20981*# National Aeronautics and Space Administration, Washington, D. C.
SPACE SCIENCE AND PRACTICAL APPLICATIONS
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 319-326 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 05B

The interrelationships between space science research,

practical applications, and funding are investigated in a historial context. M.G.

N81-20982*# National Aeronautics and Space Administration, Washington, D. C.
CONTINUING HARVEST: THE BROADENING FIELD OF SPACE SCIENCE
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 327-369 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 05B

The contributions of space techniques to various fields of science including geodesy, atmospheric and ionospheric studies, meteorology, the magnetosphere, planetology, X-ray astronomy, and solar physics, are described. M.G.

N81-20983*# National Aeronautics and Space Administration, Washington, D. C.
OBJECTIVES, PLANS, AND BUDGETS c81
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 373-392 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 05A

Government support of NASA is examined in a historical context, and the management strategies employed to meet the basic NASA objectives are discussed. M.G.

N81-20984*# National Aeronautics and Space Administration, Washington, D. C.
REVIEW AND ASSESSMENT c81
In its Beyond the Atmosphere: Early Years of Space Sci. 1980 p 393-411 (For primary document see N81-20962 11-88)
Avail: NTIS MF A01; SOD HC $11.00 CSCL 05A

The development of the NASA space program is reviewed. Organization and management, individual and institutional relations, and the advancements in space science are addressed. M.G.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N81-20985 Maryland Univ., College Park.
THE CHEMICAL ABUNDANCES AND PHYSICAL PARAMETERS OF RR LYRAE STARS Ph.D. Thesis
Armando Manduca 1980 136 p
Avail: Univ. Microfilms Order No. 8104961

A grid of model stellar atmospheres is calculated with a range of physical parameters which effectively cover RR Lyrae stars over all phases of their pulsation cycle. The models, calculated with the computer program MARCS, are flux-constant and include the effects of convection and line blanketing. Synthetic spectra were calculated for these models from 3000 A to 9600 A at 0.1 A resolution using the computer program SSG. These spectra were used directly in the application and also to compute theoretical colors on the UBVR, Stromgren uvby, and Walraven systems for the models. The uvby colors were used in determination of effective temperature and surface gravity from photometry by various observers. A theoretical counterpart to the Barnes-Evans relation between the visual surface brightness and V-R color was established from the grid models. The sensitivity of this relation to surface gravity and metal abundance was studied. Dissert. Abstr.

N81-20986 California Inst. of Tech., Pasadena.
STUDIES OF STELLAR POPULATIONS: STAR CLUSTERS IN M31, THE GALAXY AND THE MAGELLANIC CLOUDS Ph.D. Thesis
Douglas Mark Rabin 1981 228 p
Avail: Univ. Microfilms Order No. 8109126

Medium resolution spectra of the integrated light of star clusters in our own Galaxy and in three nearby systems M31 and the two Magellanic Clouds are described. Since only integrated properties will normally be observable for clusters in more distant galaxies, or for the galaxies themselves, it is important to develop quantitative techniques which relate features of the integrated light to physical characteristics such as age and chemical composition. Here, digital spectra, are analyzed both internally, as multivariate data sets, and externally by comparison with evolutionary models of star clusters and with detailed observations of nearby clusters. Dissert. Abstr.

N81-20987 Johns Hopkins Univ., Baltimore, Md.
FAR-ULTRAVIOLET SPECTRAL AND SPATIAL IMAGING OF JUPITER AND SATURN Ph.D. Thesis
John Terrel Clarke 1981 142 p
Avail: Univ. Microfilms Order No. 8106597

Observations of the far-ultraviolet emission of Jupiter and Saturn were performed with both spectral and spatial (angular) imaging, employing both a sounding rocket and the International Ultraviolet Explorer satellite. Spatial imaging of the H Ly alpha emission of Jupiter was carried out over a period of 1 1/2 years, showing a dramatic decrease in an equatorial bright region, and bursts of H Ly alpha emission were detected on Saturn. The polar aurora on Jupiter was detected and seen to vary both in emission brightness and in spectral character. Spectra of Jupiter and Saturn from 1200-1950 A with a good signal-to-noise ratio were compiled, and the geometric albedos of these planets over this wavelength range were calculated. Hydrocarbon abundances in the upper atmospheres of these planets are then estimated based on hydrocarbon absorption signatures in the albedos. Finally, spectra of the Io torus are presented and estimates of the abundances of a number of ionic species are listed. Dissert. Abstr.

N81-20988*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIO JUPITER AFTER VOYAGER: AN OVERVIEW OF THE PLANETARY RADIO ASTRONOMY OBSERVATIONS
A. Boischot (Observatoire de Paris-Meudon, France), A. Lecacheux (Observatoire de Paris-Meudon, France), M. L. Kaiser, M. D. Desch, J. K. Alexander, and J. W. Warwick (Radiophysics Co., Boulder Colo.) Jun. 1980 40 p refs Submitted for publication
(NASA-TM-80718) Avail: NTIS HC A03/MF A01 CSCL 03A

Jupiter's low frequency radio emission morphology as observed by the Planetary Radio Astronomy (PRA) instrument onboard the Voyager spacecraft is reviewed. The PRA measurement capabilities and limitations are summarized following over two years of experience with the instrument. As a direct consequence of the PRA spacecraft observations, unprecedented in terms of their sensitivity and frequency coverage, at least three previous unrecognized emission components were discovered: broadband and narrow band kilometric emission and the lesser arc decametric emission. Their properties are reviewed. In addition, the fundamental structure of the decameter and hectometer wavelength emission, which is believed to be almost exclusively in the form of complex but repeating arc structures in the frequency time domain, is described. Dramatic changes in the emission morphology of some components as a function of Sun-Jupiter-spacecraft angle (local time) are described. Finally, the PRA in suit measurements of the Io plasma torus hot to cold electron density and temperature ratios are summarized. M.G.

N81-20989# British Aerospace Dynamics Group, Bristol (England). Electronic and Space Systems.
THE DESIGN STUDY OF A FAR INFRARED HETERODYNE SPECTROMETER ASSEMBLY, VOLUME 1 Final Report
Paris ESA Apr. 1980 274 p Prepared in cooperation with Farran Research Associates 2 Vol.
(Contract ESA-3772/78/NL-PP(SC))
(ESS/CCG-118-Vol-1; ESA-CR(P)-1381-Vol-1) Avail: NTIS HC A12/MF A01

The design of a high spectral resolution submillimeter wave heterodyne spectrometer assembly for spaceborne astronomy was studied. A frequency range of 300 to 500 GHz is planned with the possibility of extension to 1000 GHz. Frequency and phase lock loop control of the carcinotron local oscillator is envisaged via the power conditioner for the telescope to the spectrometer. The signal and LO beams after passing through a Michelson diplexer are combined in a Schottky barrier diode mixer giving a 4 GHz intermediate frequency signal of one GHz bandwidth. An acousto-optic (integrated Bragg cell) device will operate as

a coarse resolution (2 MHz) signal processor, while in the fine resolution mode (50 kHz) a choice exists between microscan (comprehensive spectrum analysis) and binary autocorrelator devices. A microprocessor system with manual override would be used to control the spectrometer. Required hardware developments are discussed. Author (ESA)

N81-20990# British Aerospace Dynamics Group, Bristol (England). Electronic and Space Systems.
THE DESIGN STUDY OF A FAR INFRARED HETERODYNE SPECTROMETER ASSEMBLY, VOLUME 2 Final Report
Paris ESA Apr. 1980 320 p Prepared in cooperation with Farran Research Associates 2 Vol.
(Contract ESA-3772/78/NL-PP(SC))
(ESS/CCG-118-Vol-2; ESA-CR(P)-1381-Vol-2) Avail: NTIS HC A14/MF A01

The design of a high spectral resolution sub millimeter wave heterodyne spectrometer assembly for spaceborne astronomy was studied. A frequency range of 300 to 500 GHz is planned with the possibility of extension to 1000 GHz. A microprocessor system with manual override controls the spectrometer. Subsystem studies are given for the diplexer, dichroics and optical input, mixer, IF system, local oscillator configuration, power conditioned, control loop configuration, and signal processor hardware. Required hardware developments are discussed. Author (ESA)

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N81-20991 Cornell Univ., Ithaca, N. Y.
VIRGO CLUSTER GALAXIES: NEUTRAL HYDROGEN STUDIES Ph.D. Thesis
George Helou 1980 214 p
Avail: Univ. Microfilms Order No. 8102916

Line radiation at 21 cm wavelength from neutral hydrogen (HI) in 17 galaxies in or near the Virgo cluster of galaxies was observed and mapped using the Arecibo radio-telescope. A calibration of the radio-telescope, and new gain corrections as a function of zenith angle are described. Velocity measurements, HI content and extent, and galaxy 'spin' determinations are given, and an IG map is shown for each galaxy. An analytic investigation of detailed HI profile shapes leads to a method for recovering HI surface density curves from Arecibo profiles. The method is applied to 7 galaxies, in their middle section, the HI surface density curves resemble power laws with indices from -1 to -2.5. The method works best for edge-on galaxies with large rotation velocities. Dissert. Abstr.

N81-20992 Florida Univ., Gainesville.
A STUDY OF THE INTERSTELLAR MEDIUM IN NGC 185 AND OTHER EARLY-TYPE GALAXIES Ph.D. Thesis
Douglas William Johnson 1980 131 p
Avail: Univ. Microfilms Order No. 8105587

The question of an interstellar medium in early type galaxies is considered in light of the small amounts of gas detected as neutral hydrogen (HI). A detection of 12CO is presented for the dwarf elliptical system NGC 185. The mechanisms of line formation of the J = 1 0 transition strongly imply that the emitting region is in a state of gravitational collapse. These observations are consistent with the observed dust content of the galaxy and its blue, presumable young stellar population. It is nearly certain that the galaxy is reprocessing its interstellar medium via star formation. The radial velocity of the CO cloud can be combined with the velocity data for two planetary nebulae within the system to allow rough mass calculations. Coupling this information with luminosity data indicates that the mass to luminosity ratio of the nuclear regions (within 1 arcminute) is between 5 and 18, with a value near 8 being the most probable. Observations of 10 other early type systems are also presented and discussed. Dissert. Abstr.

N81-20993 Columbia Univ., New York.
TIME-DEPENDENT CONVECTION Ph.D. Thesis
Jean-Pierre Henri Poyet 1980 268 p
Avail: Univ. Microfilms Order No. 8105092

Three separate problems are studied. The first is the onset of convection in a radially pulsating star, and the object is to find a criterion equivalent to the Schwarzschild criterion for nonpulsating stars. It is found that pulsation is destabilizing: it promotes monotonic convective instability for large horizontal scales and overstability for small horizontal scales. In the second problem the Lorenz system of ordinary differential equations is studied by a two timing method. A precise computation of symmetric periodic orbits is possible but no indication of the doubling process was found. The third problem is a search for possible time dependence in nonlinear convection of a fluid enclosed between two plates of finite conductivity and thickness with fixed heat flux at the boundary. Dissert. Abstr.

N81-20994*# National Aeronautics and Space Administration. Goddard Space Flight Center, Albuquerque, N. Mex. Lab. for High Energy Astrophysics.
CONSISTENCY OF THE STANDARD MODEL OF PRIMORDIAL NUCLEOSYNTHESIS: RESPONSE TO THE COMMENT OF OLIVE AND TURNER
F. W. Stecker Feb. 1981 5 p refs Submitted for publication
(NASA-TM-82082) Avail: NTIS HC A02/MF A01 CSCL 03B

Inconsistencies in present data when related to the baryon dominated and neutrino dominated models are considered with emphasis on the abundances of deuterium. A.R.H.

N81-20995# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DISCOVERY OF WATER VAPOR MASER IN THE LARGE MAGELLANIC CLOUD
E. Scalise, Jr. and M. A. Braz (Observatorio Nacional, Sao Paulo) Dec. 1980 7 p refs Submitted for publication
(INPE-1959-RPE/273) Avail: NTIS HC A02/MF A01

A large scale survey for detection of water vapor sources in the Large Magellanic Cloud, with use of a maser amplifier at Itapetinga Radio Observatory, led to the discovery of a source associated to N159 with line features of intensity of 7.2 Jy (233.6kms/1) and 3.2 Jy (213.9 km/s) (detection limits of the order of 1 Jy). The other molecules found in the direction of N159 have radial velocities nearly coincident. Author

N81-20996*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE COMPLEX STATE OF THE INTERPLANETARY MEDIUM OF 28-29 JULY 1977
J. H. King, R. P. Lepping, and J. D. Sullivan (MIT, Cambridge) Feb. 1981 28 p refs Submitted for publication
(NASA-TM-82095) Avail: NTIS HC A03/MF A01 CSCL 03B

Observations of plasma and magnetic field variations in the near-Earth solar wind are discussed. Both a corotating stream and a driven shock are present. The driver gas seems to be enveloped in the rising speed phase of this stream; this appearance is attributed to a convoluted surface separting the two plasma domains. The magnetic field in the post shock flow (0030-1230 UT of July 29) has a large and geoeffective southward component at times; the energy coupling coefficient reaches approximately 5.4 x 10 to the 19th power ergs/s. In the driver gas (1230 UT of July 29 to 0110 of July 30) the magnetic field is dominantly northward. The density and dynamic pressure decrease by almost two orders of magnitude (>100 to < 2 cm/3) from just behind the interplanetary shock to approximately 3 hours into the driver gas flow. The dominant magnetic field variation in the driver gas is modeled by a cloud-like structure. Significant plasma parameter variations within the driver gas are attributed to structure in the parent solar mass ejection event and to interplanetary kinematics. Author

N81-20997*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FINE-SCALE CHARACTERISTICS OF INTERPLANETARY SECTOR Technical Report, Dec. 1974 - Apr. 1975
K. W. Behannon, F. M. Neubauer (Technische Univ., Brunswick, West Germany), and H. Barnstoff (Technische Univ., Brunswick, West Germany) Oct. 1980 59 p refs

(NASA-TM-82281) Avail: NTIS HC A04/MF A01 CSCL 03B

The structure of the interplanetary sector boundaries observed by Helios 1 within sector transition regions was studied. Such regions consist of intermediate (nonspiral) average field orientations in some cases, as well as a number of large angle directional discontinuities (DD's) on the fine scale (time scales < 1 hour). Such DD's are found to be more similar to tangential than rotational discontinuities, to be oriented on average more nearly perpendicular than parallel to the ecliptic plane to be accompanied usually by a large dip (> 80%) in B and, with a most probable thickness of 3 x 10 to the 4th power km, significantly thicker previously studied. It is hypothesized that the observed structures represent multiple traversals of the global heliospheric current sheet due to local fluctuations in the position of the sheet. There is evidence that such fluctuations are sometimes produced by wavelike motions or surface corrugations of scale length 0.05 - 0.1 AU superimposed on the large scale structure.A.R.H.

N81-20998*# Colorado Univ. at Boulder. Dept. of Physics.
ACCURACY OF GRAVITATIONAL PHYSICS TESTS USING RANGES TO THE INNER PLANETS Semiannual Report, 1 Aug. 1980 - 31 Jan. 1981
Neil Ashby and Peter Bender Feb. 1981 54 p refs
(Contract NsG-7637)
(NASA-CR-164080) Avail: NTIS HC A04/MF A01 CSCL 03B

A number of different types of deviations from Kepler's laws for planetary orbits can occur in nonNewtonian metric gravitational theories. These include secular changes in all of the orbital elements and in the mean motion, plus additional periodic perturbations in the coordinates. The first order corrections to the Keplerian motion of a single planet around the Sun due to the parameterized post Newtonian theory parameters were calculated as well as the corrections due to the solar quadrupole moment and a possible secular change in the gravitational constant. The results were applied to the case of proposed high accuracy ranging experiments from the Earth to a Mercury orbiting spacecraft in order to see how well the various parameters can be determined. T.M.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N81-20999*# Hawaii Univ., Honolulu. Dept. of Earth and Planetary Science.
THE COMPOSITION OF THE MARTIAN DARK REGIONS: OBSERVATIONS AND ANALYSIS Ph.D. Thesis
Robert Bennett Singer Jan. 1980 302 p refs
(Grant NsG-7590)
(NASA-CR-164072) Avail: NTIS HC A14/MF A01 CSCL 03B

Near infrared telescopic spectrophotometry for dark regions is present and interpreted using laboratory studies of iron bearing mineral mixtures and terrestrial oxidized and unoxidized basalts. Upon closer inspection (by spacecraft) the telescopic dark regions were found to consist of large scale intermixtures of bright soil (aeolian dust) and dark materials. The dark materials themselves consist of an intimate physical association of very fine grained ferric oxide bearing material with relatively high near infrared reflectance and darker, relatively unoxidized rocks or rock fragments. While these two components could exist finely intermixed in a soil, a number of lines of evidence indicate that the usual occurrence is probably a thin coating of physically bound oxidized material. The coated rocks are dark and generally clinopyroxene bearing. The shallow band depths and low overall reflectances indicate that opaque minerals such as magnetite are probably abundant. M.G.

N81-21000*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SURFACE PENETRATORS FOR PLANETARY EXPLORATION: SCIENCE RATIONALE AND DEVELOPMENT PROGRAM
James P. Murphy, Ray T. Reynolds, Maxwell B. Blanchard, and Uel S. Clanton Mar. 1981 54 p refs
(NASA-TM-81251; A-8412) Avail: NTIS HC A04/MF A01 CSCL 03B

Work on penetrators for planetary exploration is summarized. In particular, potential missions, including those to Mars, Mercury, the Galilean satellites, comets, and asteroids are described. A baseline penetrator design for the Mars mission is included, as well as potential instruments and their status in development. Penetration tests in soft soil and basalt to study material eroded from the penetrator; changes in the structure, composition, and physical properties of the impacted soil; seismic coupling; and penetrator deflection caused by impacting rocks, are described. Results of subsystem studies and tests are given for design of entry decelerators, high-g components, thermal control, data acquisition, and umbilical cable deployment. M.G.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N81-21001# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SOLAR WIND ENERGY AND ELECTRIC FIELD TRANSFER TO THE EARTH'S MAGNETOSPHERE VIA MAGNETOPAUSE RECONNECTION
A. W. D. Gonzalez and A. L. C. deGonzalez Nov. 1980 16 p refs Submitted for publication
(INPE-1940-RPE/259) Avail: NTIS HC A02/MF A01

Some general expression for the convection and parallel electric fields as well as for the energy transfer, due to magnetopause reconnection, are derived using a nose reconnection model that takes into account the presence of the clefts. For the case of equal geomagnetic and magnetosheath field amplitudes, the expression for the power dissipated by the convection electric field reduces to the substorm parameter epsilon. This suggests that magnetopause reconnection is defined at the nose with a tilted reconnection line, but that the convection electric field is related only to the dawn dusk component of the reconnection electric field, as defined at high latitudes (clefts).
Author

N81-21002*# California Inst. of Tech., Pasadena.
ELEMENTAL COMPOSITION OF SOLAR ENERGETIC PARTICLES Ph.D. Thesis
Walter Richardson Cook, III 1981 183 p refs
(Grant NGR-05-002-160)
(NASA-CR-164061; SRL-80-5) Avail: NTIS HC A09/MF A01 CSCL 03B

The Low Energy Telescopes on the Voyager spacecraft are used to measure the elemental composition (2 < or = Z < or = 28) and energy spectra (5 to 15 MeV/nucleon) of solar energetic particles (SEPs) in seven large flare events. Four flare events are selected which have SEP abundance ratios approximately independent of energy/nucleon. The abundances for these events are compared from flare to flare and are compared to solar abundances from other sources: spectroscopy of the photosphere and corona, and solar wind measurements. The four flare average SEP composition is significantly different from the solar composition determined by photospheric spectroscopy. The average SEP composition is in agreement with solar wind abundance results and with a number of recent coronal abundance measurements. The evidence for a common depletion of oxygen in SEPs, the corona and the solar wind relative to the photosphere suggest that the SEPs originate in the corona and that both the SEPs and solar wind sample a coronal composition which is significantly and persistently different from that of the photosphere. M.G.

N81-21003# National Oceanic and Atmospheric Administration, Boulder, Colo.

SYNOPTIC SOLAR MAGNETIC FIELD MAPS FOR THE INTERVAL INCLUDING CARRINGTON ROTATION 1601-1680, MAY 5, 1973 - APRIL 26, 1979

J. Harvey, B. Gillespie, P. Miedaner, and C. Slaughter Aug. 1980 75 p refs Prepared in cooperation with Kitt Peak National Observatory, Tucson, Ariz.

(PB81-125569; UAG-77; NOAA-80100803) Avail: NTIS HC A04/MF A01 CSCL 03B

Regular observations of solar magnetic fields were made, primarily in response to the needs of the Skylab mission. Daily full disk observations were first combined into synoptic maps during the Skylab Solar Workshop on Coronal Holes and High Speed Wind Streams and were used for studies of the magnetic field strength below coronal holes and extrapolations of the magnetic field into the corona. Starting with Carrington rotation number 1681, the synoptic maps are produced and published regularly. Old data obtained prior to Carrington rotation number 1681 processed into synoptic maps in the same way as current data are processed, are presented in the same format. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N81-21004 Wisconsin Univ. - Madison.

THE NATURE OF THE SPATIAL STRUCTURE OF DIFFUSE SOFT X-RAYS IN THE DIRECTION OF THE NORTH POLAR SPUR Ph.D. Thesis

James Patrick Morrison 1980 162 p

Avail: Univ. Microfilms Order No. 8011387

The spatial structure of the X-ray sky in the direction of the North Polar Spur was examined in two energy bands, the B band (0.1 - 0.18 keV) and, the C band (0.1 - 0.28 keV). The data are shown to be inconsistent with thermal emission, absorbed or unabsorbed, from a single region at any single temperature. They are also inconsistant with the sum of emission from two separate regions, each at a different temperature, with a constant amount of absorption. A model with two emitting regions, one local with unabsorbed emission, and the other more distant with emission partially absorbed by spatially varying amounts of material was investigated. This model was compared to the data from several sounding rocket flights to derive the spatial distribution of absorbing material necessary for the model to reproduce the observed soft X-ray spatial variations.

Dissert. Abstr.

N81-21005# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

MM-WAVE AND X-RAY OBSERVASTIONS OF A CEN-A FLARE

P. Kaufmann, F. M. Strauss, N. J. Coe (Southampton Univ., England), and G. F. Carpenter (Birmingham Univ., England) Dec. 1980 7 p refs Submitted for publication

(INPE-1958-RPE/272) Avail: NTIS HC A02/MF A01

A short-term series of daily observations of Cen A obtained at 13.5 mm wavelength is reported which displays a distinctive rise-and-fall flare. Corresponding data obtained in the low energy X-ray range (4-10 keV) are also presented. Observations covered the period 4-25 December 1979, and were obtained at Itapetinga Radio Observatory and Ariel 5 satellite. Author

N81-21006*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ON THE ORIGIN OF THE MARCH 5, 1979 GAMMA RAY TRANSIENT: A VIBRATING NEUTRON STAR IN THE LARGE MAGELLANIC CLOUD

R. Ramaty, S. Bonazzola, T. L. Cline, D. Kazanas, P. Meszaros, and R. E. Lingenfelter (California Univ., San Diego) Jul. 1980 16 p refs Submitted for publication

(Grants NGR-21-002-316; NSF AST-79-11987)

(NASA-TM-80738) Avail: NTIS HC A02/MF A01 CSCL 03C

It is proposed that a vibrating neutron star in the Large Magellanic Cloud is the source of the March 5 transient. Neutron star vibrations transport energy rapidly to the surface, heat the atmosphere by wave dissipation, and decay by gravitational radiation reaction. The electromagnetic emission arises from e(+)-e(-) pairs which cool and annihilate in the strong magnetic field of the neutron star. The field also confines the pairs, and this allows the production of the redshifted annihilation feature observed in the data. The redshift implies a gravitational radiation damping time which agrees with the 0.15 second duration of the impulsive phase of the event. Thus, the March 5 transient may be both the first detection of a vibrating neutron star and indirect evidence for gravitational radiation. M.G.

99 GENERAL

N81-21007# National Bureau of Standards, Washington, D.C.

DIMENSIONS/NBS. VOLUME 64, NO. 8, OCTOBER 1980 Monthly Report, October 1980

Oct. 1980 32 p refs

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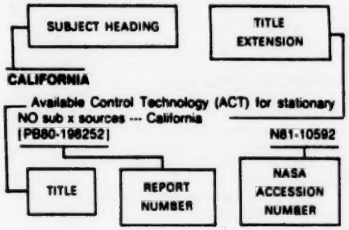
Short summaries of major technical developments, highlights of work in progress and major speeches and statements by Bureau management are presented as well as a listing of NBS publications. Articles in this issue are: A Look at Federal Office Automation, S. Radack; Safer Practice Makes Perfect, K. Kuo; Electrical Wiring: Staying on the Safe Side, G. Porter; I-C Test Structures for Random Faults, M. Baum; Temperature Reference Materials Available, SRM; Degradation of Solar Absorber Coatings, L. Masters; Test of Radiation Exposure Calculation for Reactor Pressure Vessels, E. McGarry. GRA

Typical Subject Index Listing



The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7050).

A

ABLATION
Characteristics of ablation plasma from planar, laser-driven targets
[AD-A095687] N81-20891

ABSORPTION
Kinetics of hydrogen absorption-desorption by metals
[BNL-28584] N81-20259

ABSORPTION SPECTRA
The application of photoacoustic spectroscopy to electronic spectroscopy of crystalline solids N81-20196
Development of combustion diagnostics and application to turbulent combustion
[AD-A095719] N81-20219

ABSORPTION SPECTROSCOPY
Soot in the atmosphere
[LBL-11676] N81-20616

ACCELERATION (PHYSICS)
Verification and product-improved tests of the South Coast Technology R-1 electric rabbit
[AD-A095303] N81-20959

ACCELEROMETERS
Statistical review of counting accelerometer data for Navy and Marine fleet aircraft
[AD-A095617] N81-20070

ACCESS CONTROL
Control of database access and integrity in cellular-logic devices N81-20735

ACCIDENT INVESTIGATION
Experiences with flight recorders obtained by analyzing aircraft accidents N81-20019

ACCURACY
Fidelity of simulation for pilot training
[AGARD-AR-159] N81-20091
Fidelity of simulation for pilot training. Introduction N81-20092
Pilot training N81-20093
Physiological factors N81-20094
Simulation technology N81-20095
Conclusions and recommendations --- training simulator requirements and objectives N81-20096
Pilot assessment of Training simulators N81-20098
Accuracy of gravitational physics tests using ranges to the inner planets
[NASA-CR-164080] N81-20998

ACOUSTIC ATTENUATION
Ultrasonic attenuation in normal and superconducting indium N81-20918
Attenuation of zero sound in liquid He(3)-A N81-20930

ACOUSTIC EMISSION
Acoustic emission monitoring of polymer composite materials
[NASA-TM-78523] N81-20187

ACOUSTIC EXCITATION
Structural response and input identification
[NASA-CR-164079] N81-20465

ACOUSTIC IMPEDANCE
Improved acoustic approximations for submerged shells --- spherical shells N81-20829

ACOUSTIC MEASUREMENTS
A look at remote sensing of the ocean temperature structure
[AD-A095644] N81-20524
Quantitative schlieren analysis of acoustic interaction with submerged plates N81-20828
Acoustic emission. Flaw relationship for in-service monitoring of nuclear pressure vessels
[PNL-SA-8891] N81-20834

ACOUSTIC PROPAGATION
Some aspects of the comparison between optics and nonlinear acoustics
[NASA-TM-75859] N81-20802
Boundary layer effects on an acoustic field N81-20826

ACOUSTIC SOUNDING
Analysis of the inversion monitoring capabilities of a monostatic acoustic radar in complex terrain --- Tennessee River Valley
[NASA-CR-3401] N81-20664

ACRYLIC RESINS
Toughening of epoxy resin by acrylic elastomer N81-20273

ACRYLONITRILES
Fourier transform infrared spectroscopic studies on the thermal degradation of polyacrylonitrile copolymers
[AD-A095270] N81-20277

ACTIVATED CARBON
Comparative adsorption performance of synthetic absorbents and activated carbons N81-20215

ACTIVE CONTROL
Integrated Application of Active Controls (IAAC) technology to an advanced subsonic transport: Project plan
[NASA-CR-3305] N81-20062

ACTUATORS
Actuators --- for spacecraft applications N81-20121
Evaluation of a pyrotechnic actuator concept by means of the probit statistical method. Justification of the choice of this method; application; examples of application
[CNES-78/CT/PRT/SST/SE/72] N81-20310
Analysis and simulation of a magnetic bearing suspension system for a laboratory model annular momentum control device
[NASA-TP-1799] N81-20311

ADAPTIVE CONTROL
Adaptive spread spectrum receiver using acoustic surface wave technology
[AD-A095737] N81-20347
A method for adaptive performance improvement of operation systems N81-20757
Functional series identification of nonlinear systems for adaptive control N81-20758
Simulated lumped-parameter system reduced-order adaptive control studies
[NASA-CR-163992] N81-20760
The reduced order model problem in distributed parameter systems adaptive identification and control --- adaptive control of flexible spacecraft
[NASA-CR-164059] N81-20761

ADDITION
The generalized standard addition method: Intermetallic interferences in anodic stripping voltammetry
[AD-A095419] N81-20222

ADDITIVES
Extrinsic specific heat of phosphorus doped silicon
[INPE-1942-RPE/261] N81-20216
Effect of additives on the lean detonation limit of kerosene sprays in air
[AD-A095190] N81-20221

ADDRESSING
Study of a real-time X-Y addressable spatial filter --- for onboard satellite optical data processing
[CD-6500621/3] N81-20154

ADHESION
Determination of the effect of composition structure and electrochemical mass transport properties on adhesion and corrosion inhibition of paint films
[AD-A095293] N81-20278

ADHESION TESTS
Evaluation of the wedge cleavage test for assessment of durability of adhesive bonded joints --- epoxy resin
[RAE-TM-MAT-349] N81-20479
Adhesion and chemical vapor testing of second surface silver/glass solar mirrors
[PNL-3575] N81-20577

ADHESIVE BONDING
Scarf joints in unidirectional carbon fiber reinforced plastics --- tests of repairs made using adhesives
[BU-258] N81-20193
Conference on the use of polymers N81-20285
Evaluation of the wedge cleavage test for assessment of durability of adhesive bonded joints --- epoxy resin
[RAE-TM-MAT-349] N81-20479

ADHESIVES
Formulation and evaluation of new adhesives for highway use
[PB81-129835] N81-20286

ADRENAL GLAND
Functional-morphological parallels of the hypothalamo-pituitary-adrenal system response reaction to long-term hypokinesia
[NASA-TM-76001] N81-20716

ADRENOCORTICOTROPIN (ACTH)
The role of ACTH and glucocorticoids in nonenzymatic fibrinolysis during immobilization stress in animals
[NASA-TM-76175] N81-20693

ADSORBENTS
Comparative adsorption performance of synthetic absorbents and activated carbons N81-20215

ADSORPTION
Structural and thermodynamic properties of xenon, krypton, and argon adsorbed on silver(111) N81-20924

ADSORPTIVITY
Comparative adsorption performance of synthetic absorbents and activated carbons N81-20215
Chemical and catalytic properties of elemental carbon [LBL-11678] N81-20229

ADVECTION
Mixing, convection, and advection in the upper ocean N81-20684

AERIAL PHOTOGRAPHY
Identification of irrigation practices using photographic and optical-mechanical scanning remote sensing techniques N81-20487
Applied research in analytical photogrammetry [PB81-127300] N81-20530
Semi-Automatic and automatic extraction of objects from aerial images N81-20814

AERIAL RECONNAISSANCE
Earth Resources: A continuing bibliography, issue 28 [NASA-SP-7041(28)] N81-20486
An approach to airborne infrared search set performance modeling N81-20805

AERODYNAMIC BALANCE
Application of superconducting coils to the NASA prototype magnetic balance [NASA-CR-165660] N81-20086

AERODYNAMIC CHARACTERISTICS
Aerodynamic characteristics of a hypersonic cruise aircraft concept with wing-mounted propulsion systems at Mach numbers of 2.96, 3.96 and 4.63 --- Langley unitary plan wind tunnel tests [NASA-TM-81937] N81-20025
The elaboration of a new family of helicopter blade profiles [NASA-TM-75907] N81-20031
Transonic flow past projectiles with variable nonaxisymmetric cross section [AD-A095376] N81-20033
Reasons for low aerodynamic performance of 13.5-centimeter-tip-diameter aircraft engine starter turbine [NASA-TP-1810] N81-20076

AERODYNAMIC COEFFICIENTS
Motorcycle aerodynamics in performance --- wind tunnel and driving tests [BU-253] N81-20042
The prediction of normal force and rolling moment coefficients for a spinning wing [NASA-CR-165680] N81-20068
Natural reentry of satellites: SKYLAB --- orbit calculations N81-20141

AERODYNAMIC CONFIGURATIONS
A study of high-altitude manned research aircraft employing strut-braced wings of high-aspect-ratio [NASA-CR-159262] N81-20067

AERODYNAMIC DRAG
An investigation of drag associated with the upswept rear fuselage of a helicopter [BU-257] N81-20043

AERODYNAMIC HEAT TRANSFER
Simulation of aeroheating or aerocooling Air Force stores by arrays of impinging jets [AD-A095464] N81-20034

AERODYNAMIC LOADS
Unsteady airloads on a harmonically pitching wing with external store [NLR-MP-80004-U] N81-20038
Application of linear quadratic control in reduction of aerodynamic forces on aircraft N81-20061
Wind profiles for Space Shuttle loads analysis [NASA-CR-161676] N81-20666

AERODYNAMIC NOISE
Blade vibration excitation and sound generation by flow nonuniformities N81-20429

AERODYNAMIC STABILITY
The phenomenon of dynamic stall --- vortex shedding phenomenon on oscillating airfoils [NASA-TM-81264] N81-20029
The influence of roll orientation-dependent aerodynamics on the stability of cruciform missile configurations [AD-A095269] N81-20151

AERODYNAMIC STALLING
The phenomenon of dynamic stall --- vortex shedding phenomenon on oscillating airfoils [NASA-TM-81264] N81-20029

AERODYNAMICS
Aeronautical Engineering: A continuing bibliography, supplement 132 [NASA-SP-7037(132)] N81-20005
A computer technique for detailed analysis of mission radius and maneuverability characteristics of fighter aircraft [NASA-TP-1837] N81-20026
A look at NASA's Aircraft Energy Efficiency program [PSAD-80-50] N81-20077
Aerodynamics of advanced axial-flow turbomachinery [NASA-CR-163995] N81-20079
Dual nozzle aerodynamic and cooling analysis study [NASA-CR-161677] N81-20175
Scientific and technical information output of the Langley Research Center for calendar year 1980 [NASA-TM-81950] N81-20949

AERONAUTICAL ENGINEERING
Aeronautical Engineering: A continuing bibliography, supplement 132 [NASA-SP-7037(132)] N81-20005
Summary of Jimsphere wind profiles: Programs, data, comments, part 1 --- for use in aeronautical vehicle design and engineering [NASA-CR-161664] N81-20667
Scientific and technical information output of the Langley Research Center for calendar year 1980 [NASA-TM-81950] N81-20949

AEROSOLS
Graphitic carbon in urban environments and the Arctic [LBL-11677] N81-20612
Physical and chemical characteristics of Mt. St. Helens airborne debris [LA-UR-81-110] N81-20613
Aerosol analysis for the regional air pollution study [LBL-6497] N81-20614
Soot in the atmosphere [LBL-11676] N81-20616
Metal particulate emissions from stationary sources. Volume 2: Characterization of collection filters [PB81-121154] N81-20618
Modified factor analysis of selected RAPS (Regional Air Pollution Study) aerosol data --- St. Louis, Missouri area [PB81-120784] N81-20622
Fog characteristics at Otis AFB, Massachusetts [AD-A095358] N81-20676

AEROSPACE ENGINEERING
Beyond the atmosphere: Early years of space science [NASA-SP-4211] N81-20962
Prophets and pioneers of spaceflight N81-20965
The rocket and satellites research panel: The first space scientists N81-20966
Response to Sputnik: The creation of NASA N81-20969
External relations N81-20971
Rockets and spacecraft: Sine qua non of space science N81-20972
International ties --- international cooperation in the space sciences N81-20980
Space Science and practical applications N81-20981
Continuing harvest: The broadening field of space science N81-20982
Review and assessment --- NASA space program N81-20984

AEROSPACE ENVIRONMENTS
Scientific and technical information output of the Langley Research Center for calendar year 1980 [NASA-TM-81950] N81-20949

AEROSPACE INDUSTRY
Limitless Horizons. Careers in Aerospace [NASA-EP-171] N81-20947
Management advantages of the standard work breakdown structure proposed by the European Space Agency for space satellite projects N81-20948

AEROSPACE MEDICINE
Aerospace Medicine and Biology: A continuing bibliography, supplement 216 [NASA-SP-7011(216)] N81-20704
Specialized physiological studies in support of manned space flight [NASA-CR-160936] N81-20707

AEROSPACE SCIENCES
Beyond the atmosphere: Early years of space science [NASA-SP-4211] N81-20962
The meaning of space science N81-20963
The context --- technological spinoffs from aerospace research N81-20964

AEROSPACE TECHNOLOGY TRANSFER
Scientific and technical information output of the Langley Research Center for calendar year 1980 [NASA-TM-81950] N81-20949
Space Science and practical applications N81-20981

AEROSPACE VEHICLES
The Aerospace Vehicle Interactive Design system [NASA-TM-81957] N81-20167
A comparison of damping synthesis methods for space vehicle dynamic analysis [CNES-80/CT/PRT/SST/SM/316] N81-20171

AFTERBODIES
An investigation of drag associated with the upswept rear fuselage of a helicopter [BU-257] N81-20043

AGING (METALLURGY)
Microstructure and properties of step aged rare Earth alloy magnets [LBL-11680] N81-20938

AIR
Performance of air collector house heating systems with rock bed storage --- solar heating N81-20553

AIR CONDITIONING
Lightside atmospheric revitalization system [NASA-CR-160897] N81-20731

AIR FILTERS
Metal particulate emissions from stationary sources. Volume 2: Characterization of collection filters [PB81-121154] N81-20618

AIR LAND INTERACTIONS
Comparison of observed and predicted slope winds [PNL-SA-8785] N81-20679

AIR POLLUTION
Chemical and catalytic properties of elemental carbon [LBL-11678] N81-20229
A study of gas solid reactions and air pollution detectors [AD-A095253] N81-20610
Description, evaluation, and sensitivity analyses analyses of principal US EPA air quality prediction models [ANL/EES-TM-111] N81-20611
Graphitic carbon in urban environments and the Arctic [LBL-11677] N81-20612
Aerosol analysis for the regional air pollution study [LBL-6497] N81-20614
Atmospheric Studies in Complex Terrain (ASCOT) information survey [UCID-18572] N81-20615

AIR QUALITY
The 1979 Southeastern Virginia Urban Plume Study. Volume 2: Data listings for NASA Cessna aircraft [NASA-TM-81860-2] N81-20608
Consultation for the H2S and meteorological monitoring program of the Ente Nazional per l'Energia Electtrica (ENEL) [DOE/ET-28502/1] N81-20680

AIR SAMPLING
Laser spectroscopy for the environment [BMFT-FB-T-80-014] N81-20617

AIR TRAFFIC
Evaluation of the visual acquisition range of en-route air traffic from cockpit observations [DFVLR-MITT-80-14] N81-20058

AIR TRAFFIC CONTROL
On contributions to the 10th Symposium on Aircraft Integrated Data Systems (AIDS) --- Aachen, 26-27 Mar. 1980 [DFVLR-MITT-80-09] N81-20007
Possible online uses of AIDS data in future ATC systems N81-20018
Initial design and experimental implementation of the traffic advisory service of ATARS [AD-A095462] N81-20055

The semi-operational evaluation of the trajectory prediction method for Signal Automatic Radar Processing (SARP) 2 --- air traffic control
[NLR-MP-79038-U] N81-20059

AIR TRANSPORTATION
Intercity, bus, rail, and air service for residents of rural areas
[PB81-120826] N81-20961

AIR WATER INTERACTIONS
Current-wave spectra coupling project, volume 4. Part A: Formulation of the three-dimensional structure of storm-generated currents. Part B: Summaries of volumes 1, 2 and 3 --- hurricane conditions at potential otec sites
[DOE/SF-20235/T1-VOL-4] N81-20689

AIRBORNE EQUIPMENT
Generation of optimum vertical profiles for an advanced flight management system
[NASA-CR-165674] N81-20051
In-flight calibration of the NOAA/RFC meteorological research aircraft instruments at the Air Force Eastern Test Range, 1977 - 1978
[PB81-132771] N81-20682

AIRBORNE RADAR APPROACH
Minimum operational performance standards for airborne radar approach and beacon systems for helicopters
[RTCA/DO-172] N81-20322

AIRBORNE RANGE AND ORBIT DETERMINATION
Measurement for orbit determination --- comparison of ground based satellite position observation techniques N81-20115

AIRBORNE/SPACEBORNE COMPUTERS
Autonomous spacecraft maintenance study group
[NASA-CR-164076] N81-20168

AIRCRAFT ACCIDENT INVESTIGATION
A technique for recovering nonsynchronized data from a digital flight data recorder N81-20020

AIRCRAFT ACCIDENTS
Experiences with flight recorders obtained by analyzing aircraft accidents N81-20019

AIRCRAFT ANTENNAS
Stress analysis of aircraft modifications (C-141B Aircraft). Joint Airborne Communications Center/Command Post (JACC/CP) provisions
[AD-A095634] N81-20072

AIRCRAFT CARRIERS
A continuous corrosivity monitoring device for naval environments
[AD-A095728] N81-20250

AIRCRAFT CONSTRUCTION MATERIALS
Engineering property comparisons for four AlZnMgCu type forging alloys
[NLR-TR-79022-U] N81-20270

AIRCRAFT CONTROL
An analytical study of the longitudinal response of airplanes to positive wind shear
[NASA-TP-1765] N81-20082

AIRCRAFT DESIGN
Application of a structural optimization procedure for advanced wings
[AGARD-R-691] N81-20064
A study of high-altitude manned research aircraft employing strut-braced wings of high-aspect-ratio
[NASA-CR-159262] N81-20067
Summary of Jimsphere wind profiles: Programs, data, comments, part 1 --- for use in aeronautical vehicle design and engineering
[NASA-CR-161664] N81-20667

AIRCRAFT ENGINES
Reasons for low aerodynamic performance of 13.5-centimeter-tip-diameter aircraft engine starter turbine
[NASA-TP-1810] N81-20076

AIRCRAFT EQUIPMENT
Airborne lightning warning systems: A survey
[AD-A095354] N81-20045
Target tracking using area correlation N81-20818
Autonomous target screeners N81-20822

AIRCRAFT FUEL SYSTEMS
A look at NASA's Aircraft Energy Efficiency program
[PSAD-80-50] N81-20077

AIRCRAFT GUIDANCE
Design of a fuel-efficient guidance system for a STOL aircraft
[NASA-TM-81256] N81-20006
A short note on AIDS and windshear: British airways experience --- with a modified vertical speed indicator N81-20012
Generation of optimum vertical profiles for an advanced flight management system
[NASA-CR-165674] N81-20051

AIRCRAFT HAZARDS
Airborne lightning warning systems: A survey
[AD-A095354] N81-20045

AIRCRAFT INDUSTRY
Issues of commonality. Volume 1: Executive summary
[AD-A095417] N81-20047
A look at NASA's Aircraft Energy Efficiency program
[PSAD-80-50] N81-20077

AIRCRAFT INSTRUMENTS
Testing aircraft instruments
[AD-A095680] N81-20075
Minimum operational performance standards for airborne radar approach and beacon systems for helicopters
[RTCA/DO-172] N81-20322
Minimum operational performance standards for airborne weather and ground mapping pulsed radars
[RTCA/DO-173] N81-20323
In-flight calibration of the NOAA/RFC meteorological research aircraft instruments at the Air Force Eastern Test Range, 1977 - 1978
[PB81-132771] N81-20682

AIRCRAFT MAINTENANCE
Uses of AIDS data in airlines engine maintenance N81-20016
Concept definition: Retirement for cause of F-100 rotor components
[AD-A095584] N81-20080

AIRCRAFT MANEUVERS
A computer technique for detailed analysis of mission radius and maneuverability characteristics of fighter aircraft
[NASA-TP-1837] N81-20026
Optimum maneuvers of supersonic aircraft, volumes 1 and 2 N81-20060

AIRCRAFT NOISE
Annoyance from light aircraft investigation conducted around four airports near Paris
[NASA-TM-76532] N81-20609

AIRCRAFT PARTS
Sputtering and ion plating for aerospace applications
[NASA-TM-81726] N81-20424

AIRCRAFT PERFORMANCE
Investigation of Flight Test Methods for measuring the performance of general aviation aircraft
[NASA-CR-164057] N81-20065

AIRCRAFT RELIABILITY
The F/A-18 Naval Strike Fighter: Progress has been made but problems and concerns continue
[AD-A095287] N81-20069

AIRCRAFT SAFETY
Study of materials performance model for aircraft interiors
[NASA-CR-152378] N81-20063

AIRCRAFT STABILITY
An analytical study of the longitudinal response of airplanes to positive wind shear
[NASA-TP-1765] N81-20082

AIRFOILS
The phenomenon of dynamic stall --- vortex shedding phenomenon on oscillating airfoils
[NASA-TM-81264] N81-20029
A panel method to determine loads on oscillating airfoils in transonic flow with embedded shock waves
[NLR-MP-80005-U] N81-20039

AIRFRAMES
Application of a structural optimization procedure for advanced wings
[AGARD-R-691] N81-20064

AIRPORTS
Annoyance from light aircraft investigation conducted around four airports near Paris
[NASA-TM-76532] N81-20609
Hickam AFB, Honolulu, Hawaii, revised uniform summary of Surface Weather Observations (RUSSWO), parts A-F
[AD-A095331] N81-20673

ALBEDO
New observations on the daily variations of natural ice albedo
[PB81-132789] N81-20532
Far-ultraviolet spectral and spatial imaging of Jupiter and Saturn N81-20987

ALCOHOLS
Infrared intensities of alcohols and ethers N81-20197
Office of alcohol fuels program plan, FY 1981
[DOE/AF-10001/T2] N81-20293

ALGAE
Marine biomass: Algae as source of energy
[NE/BIO-80/12] N81-20581

ALGEBRA
On bounds for the specification of finite data types by means of equations and conditional equations --- algebraic data types
[MC-IW-131/80] N81-20781

ALGORITHMS
Generation of optimum vertical profiles for an advanced flight management system
[NASA-CR-165674] N81-20051
The reentry of SKYLAB: Reentry tracking and orbit calculation
[CNES-CT/EMT/MT/MS/208] N81-20143
Hardware implementations of Fourier Transform signal processing
[PB81-123200] N81-20351
ICAP: An Interactive Cluster Analysis Procedure for analyzing remotely sensed data --- to classify the radiance data to produce a thematic map
[NASA-TM-80732] N81-20494
Coastal remote sensing investigations. Volume 2: Beach environment
[AD-A095692] N81-20688
Efficient algorithms for certain satisfiability and linear programming problems
[AD-A095411] N81-20744
Distributed routing
[AD-A095385] N81-20762
Minimum S-T cut of a planar undirected network in O(n log2(n)) time
[AD-A095539] N81-20774

ALL SKY PHOTOGRAPHY
Ionization and emission processes in the auroral and equatorial ionosphere --- support services for operation and data analysis
[AD-A095296] N81-20647

ALLOCATIONS
NASA gets under way N81-20970

ALLOYS
Interaction between computational modelling and experiments for vacuum consumable arc remelting
[SAND-80-1177C] N81-20257

ALTIMETERS
Satellite altimetric measurements of the ocean. Report of the TOPEX Science Working Group
[NASA-CR-164087] N81-20686

ALUMINUM
Platelet mechanism of erosion of ductile metals
[LBL-11341-REV] N81-20261

ALUMINUM ALLOYS
Effects of geometric variables on rub characteristics of Ti-6Al-4V
[NASA-TP-1835] N81-20245
Simultaneous stress relaxation in tension and creep in torsion of 2618 aluminum at elevated temperature
[AD-A095410] N81-20248
Melt purification via filtration
[AD-A095414] N81-20253
Studies of hydrogen embrittlement and stress-corrosion cracking in an aluminum-zinc-magnesium alloy
[DOE/ER-01198/1325] N81-20256
Engineering properties of the recently developed aluminum alloy designated 7010 --- thick plates
[NLR-TR-79017-U] N81-20269
Engineering property comparisons for four AlZnMgCu type forging alloys
[NLR-TR-79022-U] N81-20270
Microstructure and properties of A15 superconductors formed by direct precipitation
[LBL-11605] N81-20367
Evaluation of nondestructive inspection methods applied to milled step-down areas. Volume 1: Text and tables --- in aluminum alloys
[NLR-TR-78110-U-VOL-1] N81-20450
Evaluation of nondestructive inspection methods applied to milled step-down areas. Volume 2: Figures --- in aluminum alloys
[NLR-TR-78110-U-VOL-2] N81-20451
The delayed fracture of aluminum alloys --- stress corrosion cracking
[AD-A095732] N81-20468

Damage tolerance of hybrid structures --- crack propagation in aluminum alloy sheet reinforced by four unidirectional fiber/epoxy strips
[BMVG-FBWT-79-27] N81-20477

ALUMINUM OXIDES
Cermet-bonded metal pins for weldable electrical feedthroughs in alumina
[MLM-2796(OP)] N81-20279

AMAZON REGION (SOUTH AMERICA)
Daily surface pressure variations in Brazil: Their spatial distributions, origins and effects
[INPE-1974-RPE/279] N81-20659

AMMONIA
Production of ammonia in a packed-bed anaerobic upflow (ANFLOW) bioreactor
[CONF-801104-10] N81-20294
A study of gas solid reactions and air pollution detectors
[AD-A095253] N81-20610
Response of selected microorganisms to experimental planetary environments
[NASA-CR-164064] N81-20733

AMORPHOUS MATERIALS
Radiation effects in amorphous metallic alloys
[DOE/ET-10571/3] N81-20264
The retardation of crystallization of CVD amorphous silicon and the study of its structural and optical properties N81-20912
Ion implantation of krypton in sputter-deposited metal matrices --- storing krypton 85
[PNL-SA-8661] N81-20939

AMORPHOUS SEMICONDUCTORS
Fabrication of amorphous silicon solar cells, using an industrial process --- based on a nitride plasma reactor
[LEP-80.638.SME-689-A] N81-20602

AMPLIFIER DESIGN
The 31.4 GHz parametric amplifier
[NASA-CR-166643] N81-20360

AMPLIFIERS
Controlled avalanche transit-time triode amplifiers N81-20353
Self-consistent nonlinear slow-time scale formulation and simulation of overmoded gyrotron oscillators and amplifiers
[AD-A095360] N81-20361

ANAEROBES
Production of ammonia in a packed-bed anaerobic upflow (ANFLOW) bioreactor
[CONF-801104-10] N81-20294

ANALOG CIRCUITS
Combination of integrated injection logic (IIL) for UHF analog circuitry
[BMFT-FB-T-80-010] N81-20371

ANALOGIES
Analogs of Martian eolian features in southwestern Egypt N81-20640

ANALOGS
Analog rectification --- transformation of a council perspective (remote sensor imagery) into an orthogonal cylindrical perspective (map) N81-20516

ANALYSIS (MATHEMATICS)
Optimal linear approximation in project compression
[AD-A095757] N81-20799

ANALYTIC GEOMETRY
The geometry of geodesy --- to determine unknowns in position N81-20497
Principles of photogrammetry --- the geometry of scene identification and analysis N81-20504

ANGLES (GEOMETRY)
Action angle variables in classical and quantum mechanics --- a quantum analogue of classical Hamilton-Jacobi theory N81-20941

ANGULAR MOMENTUM
Correlation of aligned angular momentum with scattering angle and energy loss in deeply inelastic collisions
[DOE/ER-01388/464] N81-20840

ANISOTROPY
Computer Evaluation of Surface Topography (CEST) and applications to sheet steel finishing processes N81-20237

ANNUAL VARIATIONS
Average nocturnal and seasonal variations of sodium nightglow at 23 deg S, 46 deg W
[INPE-1957-RPE/271] N81-20634
Longitudinal differences in the spread F characteristics in the American zone and implications on the F-region dynamo
[INPE-1941-RPE/260] N81-20635

ANNULAR FLOW
Description of a digital computer simulation of an Annular Momentum Control Device (AMCD) laboratory test model
[NASA-TM-81797] N81-20741

ANODES
Characterization of the physico-chemical properties of polymeric materials for aerospace flight --- differential thermal and atomic absorption spectroscopic analysis of nickel cadmium batteries
[NASA-CR-164062] N81-20276

ANODIC STRIPPING
The generalized standard addition method: Intermetallic interferences in anodic stripping voltammetry
[AD-A095419] N81-20222

ANOMALIES
A search for the origin of low temperature anomalies in glasses N81-20922

ANTARCTIC REGIONS
A model of the Antarctic sink for stratospheric water vapor N81-20623
A study of topographically-forced surface winds in Antarctica with special emphasis on the katabatic flow at Adelie Land N81-20655
Some large scale aspects of the Southern Ocean and its environment N81-20685

ANTENNA ARRAYS
D-region electron density measurements obtained by partial reflection techniques
[AD-A095566] N81-20644

ANTENNA RADIATION PATTERNS
Diversity techniques for omnidirectional telemetry coverage of the HIMAT research vehicle
[NASA-TP-1830] N81-20074
Grating lobes N81-20333
'Finite part' electric and magnetic stored energies for planar antennas
[NASA-TM-81955] N81-20336

ANTENNAS
Payloads minimum EIRP formulations N81-20161

ANTHRAQUINONES
The effect of oxygen and anthraquinone on the alkaline depolymerization of amylose N81-20272

ANTIFRICTION BEARINGS
Magnetic bearing reaction wheel tests --- satellite applications
[CNES-80/CT/PRT/SST/SS/162] N81-20444

APPROACH
On the use of AIDS-data for a statistical analysis of wind shear during the approach N81-20010

APPROACH CONTROL
Operational considerations in utilization of microwave landing system approach and landing guidance
[NASA-TM-81945] N81-20050

APPROXIMATION
Guaranteed component-wise point-wise error bounds for approximate solutions of nonlinear two-point boundary value problems using an improved Kantorovich-like theorem N81-20740
Asymptotic boundary conditions for ordinary differential equations, 1. Numerical Hopf bifurcation, 2 N81-20768
Image processing techniques using spline approximation N81-20809
Improved acoustic approximations for submerged shells --- spherical shells N81-20829

AQUIFERS
Energy out of groundwater
[NE/HETV-80/9] N81-20565

ARC HEATING
Operating characteristics of the Langley Mach 7 Scramjet Test Facility
[NASA-TM-81929] N81-20083

ARC MELTING
Interaction between computational modelling and experiments for vacuum consumable arc remelting
[SAND-80-1177C] N81-20257

ARCHES
Dynamic stability of structural elements subjected to step loads N81-20459

ARCHITECTURE (COMPUTERS)
The A310 Aircraft Integrated Data System (AIDS) N81-20017
An analytic study of a shared device among independent computing systems N81-20755
A flexible image processing system N81-20810
Image enhancement in real time N81-20813

ARCTIC REGIONS
Graphitic carbon in urban environments and the Arctic
[LBL-11677] N81-20612
Balloon Electrical Environment Profiling System (BEEPS)
[AD-A095531] N81-20669

ARGON
Study of the ionization of C, N, O, Nr, Kr and Xe positive ions by electron impact
[ORNL-TR-4702] N81-20841
Structural and thermodynamic properties of xenon, krypton, and argon adsorbed on silver(111) N81-20924

ARGON LASERS
Single photon excimer laser photodissociation of highly vibrationally excited polyatomic molecules
[LA-UR-80-3459] N81-20847

ARIANE LAUNCH VEHICLE
Launch systems for the 1980's --- their evolution, and prospects for the STS and ARIANE sustems N81-20124
Using the ARIANE launch vehicle N81-20125
Damping synthesis for ARIANE payload coupled analyses
[CNES-79/CT/PRT/SST/SM/331] N81-20155

ARIZONA
Summary of the western energy overhead monitoring project
[PB81-129009] N81-20531

ARMOR
Molding of polypropylene film armor for radar antenna hardening applications
[AD-A095726] N81-20342

ARRAYS
Ultrasonic imaging with narrow beam insonification across a fluid-metal interface N81-20827

ARTERIES
Hypoxia in the walls of large blood vessels N81-20706

ARTIFICIAL INTELLIGENCE
A session with Tinker: Interleaving program testing with program design
[AD-A095521] N81-20746
Conceptual information retrieval
[AD-A095372] N81-20765
A TV-tracking system based on computer intelligence N81-20816

ARTIFICIAL SATELLITES
Basic notions in rational mechanics and applications to space mechanics N81-20109
Extrapolation of orbits N81-20114
Management advantages of the standard work breakdown structure proposed by the European Space Agency for space satellite projects N81-20948

ASCENT TRAJECTORIES
Spacecraft launching --- launch vehicle considerations N81-20123
Wind profiles for Space Shuttle loads analysis
[NASA-CR-161676] N81-20666

ASHES
Physical and chemical characteristics of Mt. St. Helens airborne debris
[LA-UR-81-110] N81-20613

ASPHALTENES
Hydrogen bonding in asphaltenes and coal liquids
[DOE/PC-30252/T1] N81-20227

ASSESSMENTS
Pilot assessment of Training simulators N81-20098

ASTRONOMICAL PHOTOGRAPHY
Schwarzschild camera
[NASA-CR-160061] N81-20864

ASTRONOMICAL TELESCOPES
Schwarzschild camera
[NASA-CR-160061] N81-20864

ASTRONOMY
Continuing harvest: The broadening field of space science N81-20982

ASYMMETRY
Calculation of the room-temperature shapes of unsymmetric laminates
[NASA-CR-163993] N81-20184

ASYMPTOTES
Applications of logic to finite combinatorics N81-20767

ASYMPTOTIC METHODS
An asymptotic method for determining the transport of heat and matter by creeping flows with strongly variable viscosity; Fluid-dynamic problems motivated by island arc volcanism N81-20633
Improved acoustic approximations for submerged shells --- spherical shells N81-20829
ASYMPTOTIC SERIES
An asymptotic expansion for the distribution of the location linear discriminant function
[MATH-RES-149] N81-20784
ATLANTIC OCEAN
Upper tropospheric cyclonic vortices in the tropical South Atlantic
[INPE-1946-RPE/263] N81-20660
ATMOSPHERIC BOUNDARY LAYER
Diabatic wind profile and its relation to the scale of turbulence
[INPE-1966-RPE/277] N81-20661
Boundary-layer structure over the tropical ocean N81-20683
ATMOSPHERIC CHEMISTRY
Chemical and catalytic properties of elemental carbon
[LBL-11678] N81-20229
Atmospheric Studies in Complex Terrain (ASCOT) information survey
[UCID-18572] N81-20615
ATMOSPHERIC CIRCULATION
The President's Day cyclone 17-19 February 1979: An analysis of jet streak interactions prior to cyclogenesis
[NASA-TM-82077] N81-20658
Stepwise linear regression experiments in 14 and 19 day hemispheric weather prediction
[INPE-1948-RPE/265] N81-20662
ATMOSPHERIC COMPOSITION
Graphitic carbon in urban environments and the Arctic
[LBL-11677] N81-20612
Soot in the atmosphere
[LBL-11676] N81-20616
Laser spectroscopy for the environment
[BMFT-FB-T-80-014] N81-20617
Modified factor analysis of selected RAPS (Regional Air Pollution Study) aerosol data --- St. Louis, Missouri area
[PB81-120784] N81-20622
ATMOSPHERIC DENSITY
Balloonborne lidar experiment --- atmospheric density measurements
[AD-A095366] N81-20642
ATMOSPHERIC EFFECTS
Physical and chemical characteristics of Mt. St. Helens airborne debris
[LA-UR-81-110] N81-20613
ATMOSPHERIC ELECTRICITY
The 1980 direct strike lightning data
[NASA-TM-81946] N81-20668
Balloon Electrical Environment Profiling System (BEEPS)
[AD-A095531] N81-20669
ATMOSPHERIC HEAT BUDGET
Some large scale aspects of the Southern Ocean and its environment N81-20685
ATMOSPHERIC HEATING
Measurements of possible D- and E-region telecommunications effects during ionospheric heating --- solar power satellite
[DOE/ER-10161/1] N81-20349
ATMOSPHERIC MODELS
Models of the upper Earth atmosphere. Application to satellite trajectory determination N81-20139
The reentry of SKYLAB: Reentry tracking and orbit calculation
[CNES-CT/EMT/MT/MS/208] N81-20143
A model of the Antarctic sink for stratospheric water vapor N81-20623
A simple static photochemical transport model for application to the upper atmospheres of Earth, Mars and Venus
[BMFT-FB-W-79-35] N81-20650
ATMOSPHERIC PRESSURE
Daily surface pressure variations in Brazil: Their spatial distributions, origins and effects
[INPE-1974-RPE/279] N81-20659
Stepwise linear regression experiments in 14 and 19 day hemispheric weather prediction
[INPE-1948-RPE/265] N81-20662
Revised Uniform Summary of Surface Weather Observations (RUSSWO), Lajes Fld, Terceira, Azores, parts A-F
[AD-A095330] N81-20671
ATMOSPHERIC REFRACTION
Tropospheric refractivity profiles inferred from RF measurements Passive Refractive Index by Satellite Monitoring (PRISM)
[AD-A095498] N81-20643
ATMOSPHERIC SCATTERING
Atmospheric effects on low-power laser beam propagation
[AD-A095383] N81-20418
ATMOSPHERIC SOUNDING
Analysis of the inversion monitoring capabilities of a monostatic acoustic radar in complex terrain --- Tennessee River Valley
[NASA-CR-3401] N81-20664
Early harvest: The upper atmosphere and cosmic rays N81-20968
ATMOSPHERIC TURBULENCE
Diabatic wind profile and its relation to the scale of turbulence
[INPE-1966-RPE/277] N81-20661
Statistical properties of visible and infrared beams retroreflected through a turbulent atmosphere
[LA-UR-80-3674] N81-20872
ATOMIC COLLISIONS
Atomic collision theory
[AD-A095284] N81-20838
ATOMIC ENERGY LEVELS
Atomic inner-shell processes
[AD-A095415] N81-20837
ATOMIC SPECTRA
Metal-metastable energy transfer for atomic luminescence N81-20203
ATOMS
Theoretical studies of atom surface interactions
[AD-A095341] N81-20839
ATS 6
Satellite-aided mobile communications limited operational test in the trucking industry
[NASA-CR-166658] N81-20337
ATTENUATION
Lidar observations at 0.7 micrometers and 10.6 micrometers wavelengths during Smoke Week 2
[AD-A095356] N81-20341
ATTITUDE INDICATORS
Principles and sensors for attitude measurement --- satellite applications N81-20120
AUDITORY DEFECTS
Meniere's disease: A surgeon's tactics
[NASA-TM-76398] N81-20719
AUDITORY PERCEPTION
Meniere's disease: A surgeon's tactics
[NASA-TM-76398] N81-20719
AUDITORY SENSATION AREAS
Meniere's disease: A surgeon's tactics
[NASA-TM-76398] N81-20719
AURORAL ELECTROJETS
Auroral Electrojet magnetic activity indices AE(12) for July-December 1975
[PB81-125551] N81-20653
AURORAL ZONES
An investigation of high frequency propagation over an auroral sub-auroral path --- prediction of usable frequencies
[RAE-TM-RAD-NAV-138] N81-20350
Ionization and emission processes in the auroral and equatorial ionosphere --- support services for operation and data analysis
[AD-A095296] N81-20647
AURORAS
The equatorial latitude of auroral activity 1972 - 1977 --- dmsp satellite observation
[PB81-132912] N81-20654
AUSTENITE
Mechanism of work hardening in Hadfield manganese steel N81-20243
AUTOMATED GUIDEWAY TRANSIT VEHICLES
Passenger value structure model: Automated Guideway Transit Technology program
[PB81-120875] N81-20960
AUTOMATIC CONTROL
The semi-operational evaluation of the trajectory prediction method for Signal Automatic Radar Processing (SARP) 2 --- air traffic control
[NLR-MP-79038-U] N81-20059
A TV-tracking system based on computer intelligence N81-20816
Target tracking using area correlation N81-20818
Autonomous target screeners N81-20822
Evaluation of a realtime prototype automatic target cuer N81-20823
Digital image processing for ground target detection, identification and location N81-20824
AUTOMATIC GAIN CONTROL
Automatic gain control --- the Loran-C receiver
[NASA-CR-164082] N81-20053
AUTOMATIC LANDING CONTROL
Operational considerations in utilization of microwave landing system approach and landing guidance
[NASA-TM-81945] N81-20050
AUTOMATIC TEST EQUIPMENT
Three-axis electron-beam test facility
[NASA-TP-1836] N81-20359
AUTOMATION
Automated intelligibility measurement system
[AD-A095664] N81-20739
AUTOMOBILE ENGINES
Controller for computer control of brushless dc motors --- automobile engines
[NASA-CASE-NPO-13970-1] N81-20352
Analytical design of an advanced radial turbine --- automobile engines
[NASA-CR-165170] N81-20958
AVALANCHE DIODES
Controlled avalanche transit-time triode amplifiers N81-20353
AVIONICS
Initial design and experimental implementation of the traffic advisory service of ATARS
[AD-A095462] N81-20055
Fidelity of simulation for pilot training. Introduction N81-20092
Scientific and technical information output of the Langley Research Center for calendar year 1980
[NASA-TM-81950] N81-20949
AXES OF ROTATION
Three-axis electron-beam test facility
[NASA-TP-1836] N81-20359
AXIAL FLOW TURBINES
Aerodynamics of advanced axial-flow turbomachinery
[NASA-CR-163995] N81-20079
AXISYMMETRIC BODIES
Hydrodynamic pressure and added mass for axisymmetric bodies --- finite element method
[PB81-122343] N81-20404
AZIMUTH
Error analysis and performance data from an automated azimuth measuring system
[AD-A095446] N81-20057

B

BACKGROUND RADIATION
Aircraft program for target, background, and sky radiance measurements
[AD-A095363] N81-20646
BACKSCATTERING
Measurements of lidar backscattering from clouds
[DFVLR-MITT-80-12] N81-20681
BALL BEARINGS
Life analysis of multiroller planetary traction drive
[NASA-TP-1710] N81-20423
BALLOON FLIGHT
A study of dispersion processes and climatology from the TWERL Balloon experiment N81-20022
Results of the 1980 NASA/JPL balloon flight solar cell calibration program
[NASA-CR-164078] N81-20548
BALLOON-BORNE INSTRUMENTS
Balloonborne lidar experiment --- atmospheric density measurements
[AD-A095366] N81-20642
BAND STRUCTURE OF SOLIDS
Electric conduction in n-type germanium and cadmium sulfide
[INPE-1950-RPE/266] N81-20358
Electronic properties associated with donor impurities in multivalley semiconductors --- silicon, germanium and gallium phosphites N81-20917
BANDPASS FILTERS
Delta electrical load analysis C-141B JACC/CP Aircraft
[AD-A095659] N81-20071

On the use of hierarchically computed 'Mexican Hat' features for texture discrimination
[AD-A095718] N81-20792

BANDWIDTH
'Finite part' electric and magnetic stored energies for planar antennas
[NASA-TM-81955] N81-20336
Applications of CCD and SAW devices to image processing N81-20357
Direct narrow line tuning of a high power CO2 laser
[PPPL-1736] N81-20421

BARIUM
Casting procedure for barium metal cones used in high-altitude experiments --- reusable graphite molds
[LA-8517-MS] N81-20260

BARRIER LAYERS
Growth, characterization, and applications of gallium arsenide and germanium layers grown by molecular beam epitaxy N81-20928

BASE FLOW
Subsonic axisymmetric base flow control using boundary layer thickness and near-wake mass balance variations N81-20024

BATTERY CHARGERS
Verification and product-improved tests of the South Coast Technology R-1 electric rabbit
[AD-A095303] N81-20959

BAYES THEOREM
Orbit determination: Statistical methods N81-20116
Aspects of symmetric Bayesian sequential decision problems N81-20789
Bayesian optimal designs for surveillance procedures in attribute life testing
[AD-A095723] N81-20796
A real-time video tracking system based on Bayes rule N81-20819

BEACHES
Coastal remote sensing investigations. Volume 2: Beach environment
[AD-A095692] N81-20688

BEAMS (RADIATION)
A theoretical study of microwave beam absorption by a rectenna, introduction --- solar power satellites N81-20329
Tropospheric/ionospheric transmission tests N81-20335

BEAMS (SUPPORTS)
Graphite composite truss welding and cap section forming subsystems. Volume 2: Program results
[NASA-CR-160932] N81-20463

BEARINGS
Transfer film evaluation for shuttle engine turbopump bearing
[NASA-CR-161672] N81-20425
Dry lubrication of high temperature silicon nitride rolling contacts
[AD-A095202] N81-20435

BENDING MOMENTS
Application of the line-spring model to a cylindrical shell containing a circumferential or axial part-through crack N81-20464

BENDING VIBRATION
Time-average optical methods for strain analysis N81-20453

BIBLIOGRAPHIES
Aeronautical Engineering: A continuing bibliography, supplement 132
[NASA-SP-7037(132)] N81-20005
Support interference of wind tunnel models: A selective annotated bibliography
[NASA-TM-81909] N81-20084
Earth Resources: A continuing bibliography, issue 28
[NASA-SP-7041(28)] N81-20486
Carbon dioxide and climate: A bibliography
[DOE/TIC-3382] N81-20677
Aerospace Medicine and Biology: A continuing bibliography, supplement 216
[NASA-SP-7011(216)] N81-20704
Scientific and technical information output of the Langley Research Center for calendar year 1980
[NASA-TM-81950] N81-20949
Data bases available at the National Bureau of Standards library
[PB81-132870] N81-20955

BIG BANG COSMOLOGY
Consistency of the standard model of primordial nucleosynthesis: Response to the comment of Olive and Turner
[NASA-TM-82082] N81-20994

BINDING
Concentration dependent thermal release of helium-3 implanted in molybdenum N81-20241

BINOMIALS
On a class of multivariate negative binomial distributions
[AD-A095445] N81-20793

BIOASSAY
Laser fluorescence immunoassay N81-20206
Elemental distributions of biological materials by ion microscopy N81-20211

BIOASTRONAUTICS
Life sciences: No place in the Sun --- NASA management N81-20978

BIOLOGICAL EFFECTS
Islet in weightlessness: Biological experiments on board COSMOS 1129 satellite
[NASA-TM-76396] N81-20692
Preliminary results of scientific research on biosatellite Kosmos-1129
[NASA-TM-76287] N81-20700
Design, construction and testing of a dc bioeffects test enclosure for small animals --- simulating the environment of high voltage dc transmission lines
[DOE/RA-10157/1] N81-20702
Aerospace Medicine and Biology: A continuing bibliography, supplement 216
[NASA-SP-7011(216)] N81-20704

BIOMASS
Liquefaction of biomass
[LBL-PUB-350] N81-20576

BIOMASS ENERGY PRODUCTION
Conversion of cellulosic wastes to liquid fuels
[COO-2982-57] N81-20306
Marine biomass: Algae as source of energy
[NE/BIO-80/12] N81-20581

BIOMETRICS
Multifunctional transducer
[NASA-CASE-NPO-14329-1] N81-20703

BIOSATELLITES
Islet in weightlessness: Biological experiments on board COSMOS 1129 satellite
[NASA-TM-76396] N81-20692

BIPOLAR TRANSISTORS
Monolithic integrated semiconductor switches with low on-resistance --- for private automatic branch exchange (PABX) applications
[BMFT-FB-T-80-016] N81-20373

BIREFRINGENCE
Flat display panel in liquid crystal technology
[BMFT-FB-T-80-012] N81-20876

BISMUTH ALLOYS
Fluxoid pinning by planar defects in Pb-Bi alloy films N81-20927

BITUMENS
The development and evaluation of an automated reflectance microscope system for the petrographic characterization of bituminous coals N81-20488

BIVARIATE ANALYSIS
A Monte Carlo comparison of robust and resistant estimators of bivariate correlation N81-20785

BLADE TIPS
Effects of geometric variables on rub characteristics of Ti-6Al-4V
[NASA-TP-1835] N81-20245

BLANKETS (FUSION REACTORS)
Commerical tandem mirror reactor design with thermal barriers: WITAMIR-I
[UWFDM-375] N81-20887
Fusion technology development: First wall/blanket system and component testing in existing nuclear facilities
[EGG-FT-5281] N81-20903

BLINDS
Fast detonator-activated ball shutter for high explosive experiments
[UCID-18814] N81-20409

BLOOD CIRCULATION
Comparison of early reactions of the blood system in rats to immobilization, the action of hypoxia and the administration of erythopoietin
[NASA-TM-76169] N81-20699

BLOOD COAGULATION
The role of ACTH and glucocorticoids in nonenzymatic fibrinolysis during immobilization stress in animals
[NASA-TM-76175] N81-20693

BLOOD FLOW
Noninvasive aortic bloodflow by Pulsed Doppler Echocardiography (PDE) compared to cardiac output by the direct Fick procedure N81-20709
Beat by beat stroke volume assessment by PDE in upright and supine exercise N81-20710
Changes in cardiac output and tibial artery flow during and after progressive LBNP N81-20712

BLOOD VESSELS
Changes in mast cells and in permeability of mesenteric microvessels under the effect of immobilization and electrostimulation
[NASA-TM-75988] N81-20694
Role of a decrease in body heat content in the thermoregulatory reaction of the concha auriculae vessels
[NASA-TM-76370] N81-20717

BLOOD VOLUME
Instantaneous stroke volume by PDE during and after constant LBNP (-50 torr) N81-20711

BLOWDOWN WIND TUNNELS
Comments on settling chamber design for quiet, blowdown wind tunnels
[NASA-TM-81948] N81-20085

BODIES OF REVOLUTION
Further studies on magnus phenomena on spinning and coning bodies
[AD-A095193] N81-20032

BODY TEMPERATURE
Role of a decrease in body heat content in the thermoregulatory reaction of the concha auriculae vessels
[NASA-TM-76370] N81-20717

BOEING 737 AIRCRAFT
Operational considerations in utilization of microwave landing system approach and landing guidance
[NASA-TM-81945] N81-20050

BOLTZMANN TRANSPORT EQUATION
Advanced theoretical methods for improving the performance of thermionic converters --- Boltzmann equation solutions
[DOE/ET-15422/5] N81-20560

BONE MARROW
Comparison of early reactions of the blood system in rats to immobilization, the action of hypoxia and the administration of erythopoietin
[NASA-TM-76169] N81-20699

BONES
Effect of six-month hypokinesia in dogs on mineral component, reconstruction and mechanical properties of bone tissue
[NASA-TM-76168] N81-20698
Development of a new noninvasive method to determine the integrity of bone in vivo
[NASA-CR-160922] N81-20722

BOUNDARIES
Sausage mode stability boundaries: Enumeration and verification
[UCID-18879] N81-20851

BOUNDARY LAYER EQUATIONS
Computation of unsteady turbulent boundary layers with flow reversal and evaluation of two separate turbulence models
[NASA-TM-81259] N81-20384

BOUNDARY LAYER FLOW
Measurements of a separating turbulent boundary layer
[AD-A095252] N81-20394
The aerospace thermal model (HFLUX): Its structure and utility
[AD-A095359] N81-20397
Transient boundary-layer flows in combustion environments
[UCRL-84519] N81-20401

BOUNDARY LAYER PLASMAS
Structure of the low latitude boundary layer
[NASA-CR-164056] N81-20638

BOUNDARY LAYER SEPARATION
Leading-edge separation from a slender rolling wing-body combination --- vortex sheet model
[RAE-TR-80039] N81-20040

BOUNDARY LAYERS
Subsonic axisymmetric base flow control using boundary layer thickness and near-wake mass balance variations N81-20024
HC quench layer formation in combustion processes
[DOE/ET-15303/T5] N81-20236
Boundary layer effects on an acoustic field N81-20826
Electrode boundary layers in dense, diffuse plasmas
[AD-A095250] N81-20892

BOUNDARY VALUE PROBLEMS
Numerical solution of three-dimensional Navier-Stokes equations on an arbitrarily shaped body using a locally one-dimensional scheme N81-20023
Finite-difference method for the arbitrary cross-section waveguide problem using the best-fit boundary approximation
[INPE-1956-RPE/270] N81-20049
Silent boundary methods for transient wave analysis N81-20378
A green-function method for wave interaction with a submerged body
[PB81-122269] N81-20403
Guaranteed component-wise point-wise error bounds for approximate solutions of nonlinear two-point boundary value problems using an improved Kantorovich-like theorem N81-20740
Asymptotic boundary conditions for ordinary differential equations, 1. Numerical Hopf bifurcation, 2 N81-20768
Finite elements for initial value problems in dynamics
[AD-A095344] N81-20776
On the determination of boundary collocation points for solving some problems for the Laplace operator
[TRITA-NA-8006] N81-20782

BOUSSINESQ APPROXIMATION
Finite element simulations of stratified flow over simple geometrical obstructions and arbitrarily complex terrain N81-20607
Mixing, convection, and advection in the upper ocean N81-20684
Time-dependent convection N81-20993

BOW WAVES
On the complex state of the interplanetary medium of 28-29 July 1977
[NASA-TM-82095] N81-20996

BOX BEAMS
Static test of a wing box structure made of composite materials, phase 1
[FFA-TN-HU-2127] N81-20481

BRAZIL
Longitudinal differences in the spread F characteristics in the American zone and implications on the F-region dynamo
[INPE-1941-RPE/260] N81-20635
Brazilian magnetic anomaly
[INPE-1935-RPE/258] N81-20636
Daily surface pressure variations in Brazil: Their spatial distributions, origins and effects
[INPE-1974-RPE/279] N81-20659
Upper tropospheric cyclonic vortices in the tropical South Atlantic
[INPE-1946-RPE/263] N81-20660
Atmospheric ozone measurements in Brazil data bulletin no. 1, 1974 - 1976
[INPE-1985-RPE/282] N81-20663

BREEDER REACTORS
Fusion technology development: First wall/blanket system and component testing in existing nuclear facilities
[EGG-FT-5281] N81-20903

BREMSSTRAHLUNG
Evidence for self-focusing or filamentation from X-ray, 3/2 omega 0, and 2 omega 0 emission
[AD-A095450] N81-20416
Brazilian magnetic anomaly
[INPE-1935-RPE/258] N81-20636

BRIDGMAN METHOD
Advanced methods for preparation and characterization of infrared detector materials --- mercury cadmium tellurides
[NASA-CR-161598] N81-20863

BRIGHTNESS
Average nocturnal and seasonal variations of sodium nightglow at 23 deg S, 46 deg W
[INPE-1957-RPE/271] N81-20634
Real-time grey-level histogram manipulation N81-20807

BRIGHTNESS TEMPERATURE
Snow water equivalent determination by microwave radiometry
[NASA-TM-82074] N81-20490

BRILLOUIN ZONES
Superstructure phonons and their characterization by Raman Spectroscopy --- zincblende and metal oxides N81-20929

BRITTLENESS
Non-destructive failure prediction for brittle solids
[LBL-10341-REV] N81-20448

BROADBAND
The 31.4 GHz parametric amplifier
[NASA-CR-166643] N81-20360
Results on the performance of a broad hand focusing Cherenkov counter
[COO-3072-119] N81-20410

BROMINE
Development of zinc-bromine batteries for utility energy storage
[DOE/ET-29345/21] N81-20591

BROMINE COMPOUNDS
Gas chromatography of polybrominated biphenyls utilizing electron capture detection N81-20199

BUCKLING
Fracture mechanics and dynamic response of structures
[AD-A095272] N81-20469
Cyclic inelastic buckling of tubular steel braces
[PB81-124885] N81-20484

BUDGETS
The 1981 Budget of the German Federal Ministry for Research and Technology
[NASA-TM-76493] N81-20956

BUILDINGS
Building thermal loads calculations N81-20557

BUMPY TORUSES
Plasma fluctuation measurements in ELMO Bumpy Torus
[ORNL/TM-7530] N81-20898

BURNING RATE
A theoretical investigation of the pyrolysis of solid fuels including condensation effects N81-20213

BURSTS
On the origin of the March 5, 1979 gamma ray transient: A vibrating neutron star in the Large Magellanic Cloud
[NASA-TM-80738] N81-21006

BYPASSES
The optimum design of by-pass engines with jet mixing
[PNR-90017] N81-20081

C

C-135 AIRCRAFT
Ionization and emission processes in the auroral and equatorial ionosphere --- support services for operation and data analysis
[AD-A095296] N81-20647

C-141 AIRCRAFT
Delta electrical load analysis C-141B JACC/CP Aircraft
[AD-A095659] N81-20071

CADMIUM COMPOUNDS
Characterization of the physico-chemical properties of polymeric materials for aerospace flight --- differential thermal and atomic absorption spectroscopic analysis of nickel cadmium batteries
[NASA-CR-164062] N81-20276

CADMIUM SULFIDES
Electric conduction in n-type germanium and cadmium sulfide
[INPE-1950-RPE/266] N81-20358

CADMIUM TELLURIDES
Low cost, sprayed CdTe solar cell research
[SERI/PR-8104-3-T2] N81-20585

CALCIUM
Effect of six-month hypokinesia in dogs on mineral component, reconstruction and mechanical properties of bone tissue
[NASA-TM-76168] N81-20698

CALCIUM METABOLISM
The effect of immobilization and 3 (beta-aminoethyl)-1, 2, 4 triazol on the calcium content in gastric tissues of guinea pigs during the formation of experimental ulcers
[NASA-TM-75992] N81-20691

CALCULUS OF VARIATIONS
Finite elements for initial value problems in dynamics
[AD-A095344] N81-20776

CALIBRATING
The correction for spectral mismatch effects on the calibration of a solar cell when using a solar simulator
[NASA-CR-164074] N81-20546
Results of the 1980 NASA/JPL balloon flight solar cell calibration program
[NASA-CR-164078] N81-20548
In-flight calibration of the NOAA/RFC meteorological research aircraft instruments at the Air Force Eastern Test Range, 1977 - 1978
[PB81-132771] N81-20682

CALIFORNIA
Geology and geochronology of the Halloran Hills, southeastern California, and implications concerning mesozoic tectonics of the southwestern Cordillera N81-20628

CALORIC STIMULI
Characteristics of vestibulosensory reactions studied by experimental caloric test
[NASA-TM-76386] N81-20718

CAMERAS
Schwarzschild camera
[NASA-CR-160061] N81-20864
Orbiter Camera Payload System
[NASA-CR-160937] N81-20865

CANADA
Study of the potential for cogeneration in Canada: Industrial steam turbines. Volume 1: Main report
[NP-25187-VOL-1] N81-20563

CANOPIES
ICAP: An Interactive Cluster Analysis Procedure for analyzing remotely sensed data --- to classify the radiance data to produce a thematic map
[NASA-TM-80732] N81-20494

CANOPIES (VEGETATION)
Fundamentals of remote sensing relations between spectral signatures and physical properties of crops
[NLR-MP-79035-U] N81-20527

CAPACITORS
Crystal defects in large scale integrated circuits of silicon --- and implications for crystal growth process control
[BMFT-FB-T-79-156] N81-20369

CAPE KENNEDY LAUNCH COMPLEX
Wind profiles for Space Shuttle loads analysis
[NASA-CR-161676] N81-20666
Summary of Jimsphere wind profiles: Programs, data, comments, part 1 --- for use in aeronautical vehicle design and engineering
[NASA-CR-161664] N81-20667

CAPILLARY TUBES
Detection of metal ions by glass capillary gas chromatographic separation of their volatile chelates N81-20212

CARBON
Carbon/graphite composite material study
[NASA-CR-164084] N81-20189
Chemical and catalytic properties of elemental carbon
[LBL-11678] N81-20229
Development of unique catalysts for hydrogenitrogenation of coal-derived liquids
[DOE/ET-03297/1] N81-20295
Soot in the atmosphere
[LBL-11676] N81-20616
Study of the ionization of C, N, O, Nr, Kr and Xe positive ions by electron impact
[ORNL-TR-4702] N81-20841

CARBON CYCLE
Carbon dioxide and climate: A bibliography
[DOE/TIC-3382] N81-20677

CARBON DIOXIDE
Carbon dioxide and climate: A bibliography
[DOE/TIC-3382] N81-20677

CARBON DIOXIDE LASERS
Ignition of a liquid fuel under high intensity radiation
[AD-A095691] N81-20223

The microstructural and property changes of laser treated electrodeposits
[AD-A095345] N81-20254
Direct narrow line tuning of a high power CO2 laser
[PPPL-1736] N81-20421
Single photon excimer laser photodissociation of highly vibrationally excited polyatomic molecules
[LA-UR-80-3459] N81-20847
Inertial fusion program
[LA-7755-PR] N81-20901

CARBON FIBER REINFORCED PLASTICS
Scarf joints in unidirectional carbon fiber reinforced plastics --- tests of repairs made using adhesives
[BU-258] N81-20193

CARBON MONOXIDE
Catalytic synthesis of hydrocarbons over group 8 of the reaction mechanism metals: A discussion
[LBL-11339] N81-20230
A study of gas solid reactions and air pollution detectors
[AD-A095253] N81-20610

CARBON STEELS
Passivation of carbon steel through mercury implantation
[NASA-CR-165292] N81-20244

CARBON-CARBON COMPOSITES
Friction and wear studies of graphite and a carbon-carbon composite in air and helium
[GA-A-16054] N81-20191

CARBONACEOUS MATERIALS
Comparative adsorption performance of synthetic absorbents and activated carbons N81-20215

CARDIAC VENTRICLES
Activity of the right cardiac ventricle and metabolism in healthy persons during an orthostatic test after short term immobilization
[NASA-TM-76519] N81-20726

CARDIOVASCULAR SYSTEM
Beat by beat stroke volume assessment by PDE in upright and supine exercise N81-20710

CARGO AIRCRAFT
Issues of commonality. Volume 1: Executive summary
[AD-A095417] N81-20047

CARRIER FREQUENCIES
Subjective evaluation of FM/FM protection radio for television broadcasting by satellite, appendices
[CRC-1340] N81-20325

CARRIER INJECTION
Combination of integrated injection logic (IIL) for UHF analog circuitry
[BMFT-FB-T-80-010] N81-20371

CARTAN SPACE
A spin coefficient approach to Weyssenhoff fluids in Einstein-Cartan theory
[MATH-RES-153] N81-20801
Ghost neutrinos in Einstein-Cartan theory --- a Newman-Penrose type formalism
[MATH-RES-146] N81-20945
A Newman-Penrose type formalism for space-times with torsion. Part 3: Neutrino fields in Einstein-Cartan theory
[MATH-RES-147-PT-3] N81-20946

CARTESIAN COORDINATES
An application of the embedded grid technique to the calculation of transonic flow past wings --- Cartesian grids and programming
[FFA-TN-AU-1600] N81-20036

CARTILAGE
Experimental joint immobilization in guinea pigs. Effects on the knee joint
[NASA-TM-76067] N81-20696

CASCADE FLOW
Theoretical studies of three dimensional transonic flow through a compressor blade row
[AD-A095707] N81-20035
Aerodynamics of advanced axial-flow turbomachinery
[NASA-CR-163995] N81-20079

CASTING
Casting procedure for barium metal cones used in high-altitude experiments --- reusable graphite molds
[LA-8517-MS] N81-20260
Die casting
[PB81-123697] N81-20314

CATALOGS
Catalog of French cold gas equipment for use in space applications
[CNES-CT/PRT/SST/SE/349] N81-20313

CATALYSTS
Alloy catalysts with monolith supports for methanation of coal-derived gases
[FE-2729-11] N81-20232
Development of unique catalysts for hydrogenitrogenation of coal-derived liquids
[DOE/ET-03297/1] N81-20295

CATALYTIC ACTIVITY
Applied research and evaluation of process concepts for liquefaction and gasification of western coals
[DOE/ET-10527/T1] N81-20292

CATECHOLAMINE
Change in energy expenditure and brain and adrenal content of catecholamines in rats during muscular loading and hypokinesia
[NASA-TM-76148] N81-20697

CATHODES
Characterization of the physico-chemical properties of polymeric materials for aerospace flight --- differential thermal and atomic absorption spectroscopic analysis of nickel cadmium batteries
[NASA-CR-164062] N81-20276

CAVITATION CORROSION
Investigation into the behavior of titanium and titanium alloys under cavitational stress --- droplet impinger
[GEC-TRANS-2071] N81-20265

CAVITATION FLOW
Dynamics of cavitating cascades --- transfer functions
[NASA-CR-161673] N81-20382

CELESTIAL BODIES
The solar system --- description and physics N81-20135

CELESTIAL GEODESY
Space and time reference systems N81-20111
Dynamic spatial geodesy --- to determine the Earth's gravitational field by satellite trajectory analysis N81-20499

CELESTIAL MECHANICS
The solar system --- description and physics N81-20135

CELLS (BIOLOGY)
Changes in mast cells and in permeability of mesenteric microvessels under the effect of immobilization and electrostimulation
[NASA-TM-75986] N81-20694

CELLULOSE
Conversion of cellulosic wastes to liquid fuels
[COO-2982-57] N81-20306
Liquefaction of biomass
[LBL-PUB-350] N81-20576

CEMENTS
Radiation effects in crystalline high-level nuclear waste solids
[PNL-SA-8732] N81-20858

CENTAURUS CONSTELLATION
MM-wave and X-ray observastions of a Cen-A flare
[INPE-1958-RPE/272] N81-21005

CERAMICS
Mechanisms of elevated temperature rupture in single phase ceramics
[DOE/ER-10591/1] N81-20280
Ceramic components for gas turbines --- product design and manufacturing specification
[BMFT-FB-T-79-153] N81-20281
Investigation of fabrication, composition and properties of new high temperature ceramics based on silicon nitride
[BMFT-FB-T-79-174] N81-20283
MHD air heater development technology
[DOE/ET-15602/T2] N81-20590
Radiation effects in crystalline high-level nuclear waste solids
[PNL-SA-8732] N81-20858

CEREBRUM
Objective appraisal of tolerance to ventriculography with various radiocontrast media (according to electronystagmography data)
[NASA-TM-76340] N81-20721

CERENKOV COUNTERS
Results on the performance of a broad hand focusing Cherenkov counter
[COO-3072-119] N81-20410

CERMETS
Cermet-bonded metal pins for weldable electrical feedthroughs in alumina
[MLM-2796(OP)] N81-20279

CHANNELS (DATA TRANSMISSION)
Preliminary interface revision notice SD-152C update of section 8.3 of ICD 2-19001 for detached payloads N81-20163
Logical channel theory
[AD-A095663] N81-20737
FASTBUS system used in a high energy experiment
[BNL-28613] N81-20855

CHARGE COUPLED DEVICES
Hardware implementations of Fourier Transform signal processing
[PB81-123200] N81-20351
Applications of CCD and SAW devices to image processing N81-20357
Solid state imagers --- imaging and image storage
[BMFT-FB-T-80-009] N81-20875

CHARGE DISTRIBUTION
Experimental and theoretical studies of donor-type graphite intercalated compounds
[AD-A095282] N81-20935

CHARGED PARTICLES
Brazilian magnetic anomaly
[INPE-1935-RPE/258] N81-20636
Charged-particle cross section data for fusion plasma applications
[COO-2218-195] N81-20902

CHARM (PARTICLE PHYSICS)
Weak decays and charm searches
[COO-4831-3] N81-20846

CHELATES
Detection of metal ions by glass capillary gas chromatographic separation of their volatile chelates N81-20212

CHEMICAL ANALYSIS
Metal-metastable energy transfer for atomic luminescence N81-20203
Thermal lens calorimetry N81-20204
A trophic classification of Minnesota lakes based on lake sediments
[PB81-124141] N81-20535
Aerosol analysis for the regional air pollution study
[LBL-6497] N81-20614

CHEMICAL ATTACK
Adhesion and chemical vapor testing of second surface silver/glass solar mirrors
[PNL-3575] N81-20577

CHEMICAL BONDS
A chromatographic and spectroscopic characterization of chemically bonded stationary phases N81-20195
Infrared spectra of some sulfides and their analogs of binary composition in the long-wave region
[NASA-TM-75901] N81-20217
Raman spectra of highly conducting poly-p-phenylene complexes
[AD-A095660] N81-20218
Development of unique catalysts for hydrogenitrogenation of coal-derived liquids
[DOE/ET-03297/1] N81-20295

CHEMICAL COMPOSITION
The composition of the Martian dark regions: Observations and analysis
[NASA-CR-164072] N81-20999
Elemental composition of solar energetic particles
[NASA-CR-164061] N81-21002

CHEMICAL LASERS
A theoretical assessment of vibrational to rotational energy exchange in the hydrogen fluoride chemical laser N81-20413
Study of chemical reactions and energy transfer for high-energy and high-power lasers
[AD-A095706] N81-20414

CHEMICAL PROPERTIES
Materials data retrieval at ESTEC --- for spacecraft construction
[ESA-STM-208] N81-20954

CHEMICAL REACTION CONTROL
Actuators --- for spacecraft applications N81-20121

CHEMICAL REACTIONS
Studies in chemical ionization mass spectrometry N81-20208
Reaction rates of atmospheric gases with Lithium (Silicon) alloy
[SAND-80-1363] N81-20234
Development of unique catalysts for hydrogenitrogenation of coal-derived liquids
[DOE/ET-03297/1] N81-20295

Stoichiometry of wood liquefaction
[LBL-11776] N81-20298
Hot atom reactions involving multivalent and univalent species --- recoil (31)Si reactions
[DOE/ER-03898/52] N81-20854
Plasma chemistry for inorganic materials
[NASA-TM-75844] N81-20889

CHEMILUMINESCENCE
Metal-metastable energy transfer for atomic luminescence N81-20203
Study of chemical reactions and energy transfer for high-energy and high-power lasers
[AD-A095706] N81-20414

CHLORIDES
The photochemical transformations of organic compounds in seawater N81-20200
A feasibility study on the growth of bulk GaN single crystals
[AD-A095567] N81-20931

CHLOROPHYLLS
Development of the Coastal Zone Color Scanner for NIMBUS 7. Volume 2: Test and performance data, revision A
[NASA-CR-166649] N81-20491
Laboratory tank studies of a single species of phytoplankton using a remote sensing fluorosensor
[NASA-TP-1821] N81-20492
Critical evaluation of the radiometric requirements of satellite onboard equipment for the measurement of ocean color
[ESA-CR(P)-1390] N81-20526

CHROMATOGRAPHY
Mathematical models for dispersion of chromatographic solute bands N81-20194

CHROMIUM
Long time corrosion testing with and without mechanical stress of high temperature alloys for the blades of high output land-based gas turbines
[BMFT-FB-T-79-106] N81-20266

CIRCUIT RELIABILITY
Monolithic integrated semiconductor switches with low on-resistance --- for private automatic branch exchange (PABX) applications
[BMFT-FB-T-80-016] N81-20373

CIRCULAR PLATES
Conductivity as a tool for evaluating the homogeneity of sintered discs of transition metal oxides
[AD-A095298] N81-20249

CIRCULATORS (PHASE SHIFT CIRCUITS)
Development of a parametric amplifier for satellite transponder applications at 14 to 14.5 GHz
[BMFT-FB-W-79-27] N81-20375

CITIES
Graphitic carbon in urban environments and the Arctic
[LBL-11677] N81-20612

CIVIL AVIATION
Initial design and experimental implementation of the traffic advisory service of ATARS
[AD-A095462] N81-20055

CLASSICAL MECHANICS
Orbits near triple collision in the three body problem N81-20769
Action angle variables in classical and quantum mechanics --- a quantum analogue of classical Hamilton-Jacobi theory N81-20941

CLASSIFICATIONS
ICAP: An Interactive Cluster Analysis Procedure for analyzing remotely sensed data --- to classify the radiance data to produce a thematic map
[NASA-TM-80732] N81-20494
Performance of the discrete Fourier Transform satellite imagery classification technique
[AD-A095364] N81-20670
Coastal remote sensing investigations. Volume 2: Beach environment
[AD-A095692] N81-20688
Orthostatic hypotension
[NASA-TM-75889] N81-20728
Target detection and classification in infrared imagery N81-20806
Teamwork in target Acquisition N81-20808
A system look at real time processing for target acquisition and classification N81-20825
Materials data retrieval at ESTEC --- for spacecraft construction
[ESA-STM-206] N81-20954

CLASSIFYING
Ranking various classifications of the same data from ground truths and contingency tables --- for the reduction of multispectral band scanner image data
[ESA-CR(P)-1388] N81-20786

CLEAVAGE
Development of unique catalysts for hydrogenitrogenation of coal-derived liquids
[DOE/ET-03297/1] N81-20295
Evaluation of the wedge cleavage test for assessment of durability of adhesive bonded joints --- epoxy resin
[RAE-TM-MAT-349] N81-20479

CLIMATE
October 1980 environmental data for sites in the National Solar Data Network
[SOLAR/0010-80/10] N81-20588
Davison AAF, Ft. Belvoir Virginia, Revised Uniform Summary of Surface Weather Observations (RUSSWO), parts A-F
[AD-A095332] N81-20672
Hickam AFB, Honolulu, Hawaii, revised uniform summary of Surface Weather Observations (RUSSWO), parts A-F
[AD-A095331] N81-20673
Portland IAP, Portland, Oregon, Revised Uniform Summary of Surface Weather Observations (RUSSWO), parts A-F
[AD-A095329] N81-20675

CLIMATOLOGY
A study of dispersion processes and climatology from the TWERL Balloon experiment N81-20022
Carbon dioxide and climate: A bibliography
[DOE/TIC-3382] N81-20677

CLOUD PHOTOGRAPHY
Performance of the discrete Fourier Transform satellite imagery classification technique
[AD-A095364] N81-20670

CLOUD PHYSICS
A statistical data analysis and plotting program for cloud microphysics experiments
[NASA-CR-161663] N81-20665

CLOUDS (METEOROLOGY)
Thundercloud local electric field intensification during the pre-breakdown phase of lightning --- time and space evolution N81-20657
Measurements of lidar backscattering from clouds
[DFVLR-MITT-80-12] N81-20681

COAL
Coal preparation using magnetic separation. Volume 5: Evaluation of magnetic coal desulfurization concepts
[EPRI-CS-1517-VOL-5] N81-20302
The development and evaluation of an automated reflectance microscope system for the petrographic characterization of bituminous coals N81-20488
Critical parameters for coarse coal underground slurry haulage systems
[JPL-PUB-81-11] N81-20495

COAL DERIVED GASES
Alloy catalysts with monolith supports for methanation of coal-derived gases
[FE-2729-11] N81-20232

COAL DERIVED LIQUIDS
Hydrogen bonding in asphaltenes and coal liquids
[DOE/PC-30252/T1] N81-20227
Development of unique catalysts for hydrogenitrogenation of coal-derived liquids
[DOE/ET-03297/1] N81-20295

COAL GASIFICATION
Applied research and evaluation of process concepts for liquefaction and gasification of western coals
[DOE/ET-10527/T1] N81-20292
Molten salt coal gasification process development unit, phase 1. Volume 1: PDU operations
[DOE/ET-10296/66-VOL-1] N81-20296
Coal conversion 1979 technical report
[DOE/FE-0010] N81-20297
Coal hydrogasification process development
[DOE/ET-10328/27] N81-20304
Environmetrics of synfuels. 1: Processing the automated PDP-11 data components for the UMD gasifier facility
[ORNL/TM-7428] N81-20305
Solar coal gasification
[DOE/TIC-11384] N81-20587

COAL LIQUEFACTION
Applied research and evaluation of process concepts for liquefaction and gasification of western coals
[DOE/ET-10527/T1] N81-20292
Coal conversion 1979 technical report
[DOE/FE-0010] N81-20297

COAL UTILIZATION
Review of fusion synfuels
[BNL-28627] N81-20300
Flash pyrolysis and hydropyrolysis of coal
[BNL-28577] N81-20301
Coal hydrogasification process development
[DOE/ET-10328/27] N81-20304

COASTAL CURRENTS
HF (High Frequency) radar measurements of circulation in the Eastern Strait of Juan de Fuca near Protection Island (July 1979)
[PB81-127490] N81-20690

COASTAL WATER
Critical evaluation of the radiometric requirements of satellite onboard equipment for the measurement of ocean color
[ESA-CR(P)-1390] N81-20526

COASTAL ZONE COLOR SCANNER
Development of the Coastal Zone Color Scanner for NIMBUS 7. Volume 2: Test and performance data, revision A
[NASA-CR-166649] N81-20491

COATINGS
Raman spectra of highly conducting poly-p-phenylene complexes
[AD-A095660] N81-20218
The microstructural and property changes of laser treated electrodeposits
[AD-A095345] N81-20254
Sputtering and ion plating for aerospace applications
[NASA-TM-81726] N81-20424
Study of the effectiveness of selective absorber coatings and phase change materials in passive solar space heating
[LA-UR-80-2930] N81-20936

COBALT
Aspects of metal NMR and high sensitivity probe design N81-20201
Temperature dependences of hyperfine fields at SP-impurities in fcc-cobalt studied by nuclear spin precession following heavy-ion reactions N81-20926

COCKPITS
Evaluation of the visual acquisition range of en-route air traffic from cockpit observations
[DFVLR-MITT-80-14] N81-20058

CODERS
The effect of interference on delta modulation encoded video signals
[NASA-CR-160923] N81-20324

CODING
Precharge enhanced SGEMP
[AD-A095503] N81-20150

COEFFICIENTS
A spin coefficient approach to Weyssenhoff fluids in Einstein-Cartan theory
[MATH-RES-153] N81-20801
A Newman-Penrose type formalism for space-times with torsion. Part 2: Exact plane wave solutions
[MATH-RES-143-PT-2] N81-20944
A Newman-Penrose type formalism for space-times with torsion. Part 3: Neutrino fields in Einstein-Cartan theory
[MATH-RES-147-PT-3] N81-20946

COGENERATION
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG), volume 1
[NASA-CR-164051] N81-20538
Study of the potential for cogeneration in Canada: Industrial steam turbines. Volume 1: Main report
[NP-25187-VOL-1] N81-20563

COHERENT RADAR
Identification of irrigation practices using photographic and optical-mechanical scanning remote sensing techniques N81-20487

COHERENT RADIATION
Grating lobes N81-20333

COLD GAS
Catalog of French cold gas equipment for use in space applications
[CNES-CT/PRT/SST/SE/349] N81-20313

COLD PLASMAS
Extension of Volterra analysis to weakly nonlinear electromagnetic field problems with application to whistler propagation --- cold collisionless electron plasma N81-20319

COLD PRESSING
Forging of powder metallurgy gears
[AD-A095556] N81-20247
COLD ROLLING
The deformation of grains during cold-rolling
N81-20238
COLD TOLERANCE
Pathogenesis of sudden death following water immersion (immersion syndrome)
[NASA-TM-76542] N81-20723
COLD WORKING
An experimental study of large compressive loads upon residual strain fields and the interaction between surface strain fields created by coldworking fastener holes N81-20454
COLLISION AVOIDANCE
Initial design and experimental implementation of the traffic advisory service of ATARS
[AD-A095462] N81-20055
COLLISION PARAMETERS
Study of chemical reactions and energy transfer for high-energy and high-power lasers
[AD-A095706] N81-20414
Advanced theoretical methods for improving the performance of thermionic converters --- Boltzmann equation solutions
[DOE/ET-15422/5] N81-20560
Study of direct single photons and correlated particles in proton-proton collisions at square roots = 62-4 GeV (CCOR collaboration)
[DOE/ER-02232/94] N81-20842
Proceedings of the Beam-Beam Interaction Seminar
[SLAC-PUB-2624] N81-20856
COLLISIONLESS PLASMAS
Energization of electrons in a plasma beam entering a curved magnetic field
[TRITA-EPP-80-09] N81-20909
COLLOCATION
On the determination of boundary collocation points for solving some problems for the Laplace operator
[TRITA-NA-8006] N81-20782
Collocation method for the solution of the neutron transport equation with both symmetric and asymmetric scattering
[SAND-80-1446] N81-20843
COLOR PHOTOGRAPHY
Orbiter Camera Payload System
[NASA-CR-160937] N81-20865
COLOR TELEVISION
The effect of interference on delta modulation encoded video signals
[NASA-CR-160923] N81-20324
COMBINATORIAL ANALYSIS
Applications of logic to finite combinatorics
N81-20767
Some problems in combinatorial matrix theory
N81-20798
COMBUSTION
The influence of turbulence on combustion in open pre-mixed flames N81-20198
Development of combustion diagnostics and application to turbulent combustion
[AD-A095719] N81-20219
HC quench layer formation in combustion processes
[DOE/ET-15303/T5] N81-20236
Studies of free radicals by ultraviolet excimer laser photolysis
[DOE/ER-10396/2] N81-20419
COMBUSTION CHAMBERS
Transient boundary-layer flows in combustion environments
[UCRL-84519] N81-20401
COMBUSTION EFFICIENCY
A theoretical investigation of the pyrolysis of solid fuels including condensation effects N81-20213
Combustion of drops and sprays of heavy fuel oils and their emulsions
[AD-A095612] N81-20220
COMBUSTION PHYSICS
A study of flame spreading and combustion processes in solid propellant cracks N81-20214
Combustion of drops and sprays of heavy fuel oils and their emulsions
[AD-A095612] N81-20220
COMBUSTION PRODUCTS
Description, evaluation, and sensitivity analyses analyses of principal US EPA air quality prediction models
[ANL/EES-TM-111] N81-20611
Comparison of gas phase hydrocarbon emissions from light-duty gasoline vehicles and light-duty vehicles equipped with diesel engines
[PB81-122996] N81-20620
COMMAND AND CONTROL
Diversity techniques for omnidirectional telementry coverage of the HiMAT research vehicle
[NASA-TP-1830] N81-20074
COMMAND GUIDANCE
Generalities and definition of a system --- for command and control of satellite attitude and orbit
N81-20118
Attitude and orbit command --- guidance with spin stabilization or three axis stabilization N81-20119
COMMONALITY (EQUIPMENT)
Issues of commonality. Volume 2: Issue analysis
[AD-A095418] N81-20046
Issues of commonality. Volume 1: Executive summary
[AD-A095417] N81-20047
COMMUNICATION NETWORKS
RACE: An automatic high frequency radio telephone system for communications in remote areas
[CRC-1338-E] N81-20326
Standard software base release 3 --- communication systems applications
[AD-A095693] N81-20749
COMMUNICATION SATELLITES
Position surveillance using one active ranging satellite and time-of-arrival of a signal from an independent satellite
[NASA-CR-166647] N81-20147
COMPARISON
Experiences with flight recorders obtained by analyzing aircraft accidents N81-20019
A comparison of damping synthesis methods for space vehicle dynamic analysis
[CNES-80/CT/PRT/SST/SM/316] N81-20171
COMPATIBILITY
Study on the compatibility of SURSAT and LASS/COMSS technical mission requirements --- satellite ground tracks
[CAL-79/91-1] N81-20104
COMPONENT RELIABILITY
Development of high-temperature turbine subsystem technology to a technology readiness status, phase 2
[FE-1806-96] N81-20440
COMPOSITE MATERIALS
Evaluation of the behavior of structures made of high modulus composite materials when struck by lightning
[NASA-TM-75866] N81-20188
Photoelastic studies of internal stress distributions of unidirectional composites
[AD-A095595] N81-20190
Analysis and simulation of a magnetic bearing suspension system for a laboratory model annular momentum control device
[NASA-TP-1799] N81-20311
Graphite composite truss welding and cap section forming subsystems. Volume 1: Executive summary --- large space structures
[NASA-CR-160933] N81-20462
Graphite composite truss welding and cap section forming subsystems. Volume 2: Program results
[NASA-CR-160932] N81-20463
COMPRESSIBILITY EFFECTS
The viscoelastic behavior of the human intervertebral disc N81-20705
COMPRESSIBLE FLOW
A three-dimensional turbulent compressible subsonic duct flow analysis for use with constructed coordinate systems
[NASA-CR-3389] N81-20383
COMPRESSION LOADS
An experimental study of large compressive loads upon residual strain fields and the interaction between surface strain fields created by coldworking fastener holes N81-20454
COMPRESSOR BLADES
Theoretical studies of three dimensional transonic flow through a compressor blade row
[AD-A095707] N81-20035
COMPUTATION
Building thermal loads calculations N81-20557
On probabilistic and symmetric parallel computations
[AD-A095657] N81-20738
Parallel solution of large sparse linear equations using a processor network N81-20754
A proof of the existence of unstable periodic orbits using computer-based techniques N81-20770
COMPUTATIONAL FLUID DYNAMICS
A three-dimensional turbulent compressible subsonic duct flow analysis for use with constructed coordinate systems
[NASA-CR-3389] N81-20383
Measurements and predictions of complex turbulent flows, volume 2 --- conference, Belgium, 11-15 Feb. 1980
[VKI-LS-1980-3-VOL-2] N81-20385
COMPUTER GRAPHICS
SPIDA: A small program for interactive display and analysis --- stress analysis and heat transfer
[REL/R(79)28] N81-20476
A watershed information system
[PB81-127433] N81-20528
A statistical data analysis and plotting program for cloud microphysics experiments
[NASA-CR-161663] N81-20665
The Data from Aeromechanics Test and Analytics, Management and Analysis Package (DATAMAP). Volume 1: User's manual
[AD-A095188] N81-20745
Analysis of an assemblage of discs employing interactive graphics
[AD-A095735] N81-20750
Assistance in interpreting satellite multispectral imagery N81-20811
Semi-Automatic and automatic extraction of objects from aerial images N81-20814
COMPUTER INFORMATION SECURITY
Control of database access and integrity in cellular-logic devices N81-20735
COMPUTER NETWORKS
Star network distributed computer systems evaluation results
[AD-A095687] N81-20743
Data format translation routines
[ORNL/CSD/TM-137] N81-20752
Parallel solution of large sparse linear equations using a processor network N81-20754
An analytic study of a shared device among independent computing systems N81-20755
Distributed routing
[AD-A095385] N81-20762
COMPUTER PROGRAMMING
An application of the embedded grid technique to the calculation of transonic flow past wings --- Cartesian grids and programming
[FFA-TN-AU-1600] N81-20036
Attitude determination --- for orbiting spacecraft
N81-20122
Autonomous acquisition simulator and associated data
[AD-A095709] N81-20145
A session with Tinker: Interleaving program testing with program design
[AD-A095521] N81-20746
Modularity in non-procedural languages through abstract data types
[AD-A095546] N81-20748
Proceedings of the ADA Debut
[AD-A095569] N81-20751
Introduction to Praxis
[UCRL-52957-REV-1] N81-20753
COMPUTER PROGRAMS
An extension of the local momentum theory to a distorted wake model of a hovering rotor
[NASA-TM-81258] N81-20030
Loran-C plotting program for plotting lines of position on standard charts
[NASA-CR-164082] N81-20052
Application of a structural optimization procedure for advanced wings
[AGARD-R-691] N81-20064
LORI: A multisatellite, multisystem, time-coverage analysis program
[AD-A095537] N81-20148
Computer Evaluation of Surface Topography (CEST) and applications to sheet steel finishing processes
N81-20237

Investigations on processing and properties of high-temperature silicon carbide materials
[BMFT-FB-T-79-170] N81-20282
Numerical calculation of shock-induced initiation of detonations
[LA-UR-80-2854] N81-20303
Utilization of an efficient numerical method for viscous flow problem solutions
[AD-A095758] N81-20396
MARIAH: A finite element computer program for incompressible porous flow problems
[SAND-79-1623] N81-20402
SPIDA: A small program for interactive display and analysis --- stress analysis and heat transfer
[REL/R(79)28] N81-20476
Heat loss modeling for the ANL Research Solar Pond
[ANL-CT-80-22] N81-20589
Residential solar data center MIRADS user's guide
[PB81-132268] N81-20606
D-region electron density measurements obtained by partial reflection techniques
[AD-A095566] N81-20644
A statistical data analysis and plotting program for cloud microphysics experiments
[NASA-CR-161663] N81-20665
A formal methodology using attributed grammar for multiprocessing system design N81-20736
The Roscoe Manual. Volume 2-1: Sample case --- nuclear explosion effects
[AD-A095535] N81-20742
A session with Tinker: Interleaving program testing with program design
[AD-A095521] N81-20746
Standard software base release 3 --- communication systems applications
[AD-A095693] N81-20749
Analysis of an assemblage of discs employing interactive graphics
[AD-A095735] N81-20750
Data format translation routines
[ORNL/CSD/TM-137] N81-20752
Introduction to Praxis
[UCRL-52957-REV-1] N81-20753
Image processing
[AD-A095552] N81-20764
Alternating-direction implicit numerical solution of the time dependent, three-dimensional, Singlt fluid, resistive magnetohydrodynamic equations
[UCRL-53086] N81-20780
NASA progress in aircraft noise prediction
[NASA-TM-81915] N81-20830
A FORTRAN computer program for calculating the propagation of plane, cylindrical or spherical finite amplitude waves
[AD-A095386] N81-20832
Electrode boundary layers in dense, diffuse plasmas
[AD-A095250] N81-20892
Transient analysis of vibrations in nonideal multilayered piezoelectric devices
[SAND-80-1909] N81-20937

COMPUTER SYSTEMS DESIGN

The A310 Aircraft Integrated Data System (AIDS) N81-20017
The Aerospace Vehicle Interactive Design system
[NASA-TM-81957] N81-20167
Development of hybrid circuits --- based on thick film technology
[DH-RS-01] N81-20374
A formal methodology using attributed grammar for multiprocessing system design N81-20736
Star network distributed computer systems evaluation results
[AD-A095687] N81-20743
An analytic study of a shared device among independent computing systems N81-20755
A flexible image processing system N81-20810

COMPUTER SYSTEMS PERFORMANCE

A method for adaptive performance improvement of operation systems N81-20757

COMPUTER SYSTEMS PROGRAMS

flight data recording and data processing for light airplanes and gliders N81-20008
A quick-look system for the processing of flight data recordings N81-20021
Orbit calculation programs --- choice of hardware and implementation in function of mission requirements N81-20117
Ground equipment for moving satellites and geostationary satellites --- used in the ground support function N81-20133
Technical demonstration: An interactive system for image processing N81-20521

COMPUTER SYSTEMS SIMULATION

Simulated lumped-parameter system reduced-order adaptive control studies
[NASA-CR-163992] N81-20760

COMPUTER TECHNIQUES

A computer technique for detailed analysis of mission radius and maneuverability characteristics of fighter aircraft
[NASA-TP-1837] N81-20026
Computer techniques for ultrasonic inspection
[AD-A095285] N81-20447
Hybrid approaches and industrial applications of pattern recognition
[AD-A095562] N81-20763
A proof of the existence of unstable periodic orbits using computer-based techniques N81-20770
The complexity of provable properties of first order theories
[AD-A095656] N81-20773

COMPUTERIZED DESIGN

Application of a structural optimization procedure for advanced wings
[AGARD-R-691] N81-20064
The Aerospace Vehicle Interactive Design system
[NASA-TM-81957] N81-20167
Integrating reliability analysis and design
[ALO-131] N81-20449
Analysis of an assemblage of discs employing interactive graphics
[AD-A095735] N81-20750

COMPUTERIZED SIMULATION

A simple hybrid visual simulation for research flight simulators
[DFVLR-MITT-80-13] N81-20088
Visual system Technology: Status and problems --- training simulators N81-20099
Strapdown inertial optical system (SIOS) --- for observation and communication satellites
[REPT-0002/DX60] N81-20153
Analysis and simulation of a magnetic bearing suspension system for a laboratory model annular momentum control device
[NASA-TP-1799] N81-20311
System modeling using TRNSYS computer simulation --- solar heating N81-20555
Description of a digital computer simulation of an Annular Momentum Control Device (AMCD) laboratory test model
[NASA-TM-81797] N81-20741
The Roscoe Manual. Volume 2-1: Sample case --- nuclear explosion effects
[AD-A095535] N81-20742
Efficient algorithms for certain satisfiability and linear programming problems
[AD-A095411] N81-20744
A detection and processing scheme for moving target detection using a passive sensor N81-20815
Sausage mode stability boundaries: Enumeration and verification
[UCID-18879] N81-20851
Simulation studies of the stability of weak and strong ion layers and rings N81-20882

CONCENTRATORS

Cost/performance of solar reflective surfaces for parabolic dish concentrators
[NASA-CR-164088] N81-20547
Further development of a novel solar cell concentrator photovoltaic converter system
[SAND-80-7072] N81-20572
Solar collector foundation designs
[SAND-80-7070] N81-20582
The 10-kilowatt photovoltaic concentrator array fabrication
[SAND-80-7062] N81-20599

CONCRETE STRUCTURES

Category 1 structures: Safety margin at ultimate load
[LA-UR-80-2858] N81-20472

CONDUCTIVE HEAT TRANSFER

A study of flame spreading and combustion processes in solid propellant cracks N81-20214

CONES

Casting procedure for barium metal cones used in high-altitude experiments --- reusable graphite molds
[LA-8517-MS] N81-20260

CONFERENCES

On contributions to the 10th Symposium on Aircraft Integrated Data Systems (AIDS) --- Aachen, 26-27 Mar. 1980
[DFVLR-MITT-80-09] N81-20007
Space vehicle orbital motion --- conferences
[ISSN-0244-8041] N81-20108
Shuttle/payload communications and data systems interface analysis
[NASA-CR-160929] N81-20157
Conference on the use of polymers N81-20285
Measurements and predictions of complex turbulent flows, volume 2 --- conference, Belgium, 11-15 Feb. 1980
[VKI-LS-1980-3-VOL-2] N81-20385
Steam turbines for large power outputs --- conference, Belgium, 11-15 Feb. 1980
[VKI-LS-1980-6] N81-20426
Spaceborne cartography of the Earth --- conference; Toulouse, 5-19 Jun. 1979 N81-20496
Heat exchange and solar energy, volume 2 --- conference proceedings, Rhode Saint Genese, Belguim
[VKI-LEC-SER-1980-2-VOL-2] N81-20549
Proceedings of the ADA Debut
[AD-A095569] N81-20751
Image and Sensor Data Processing for Target Acquisition and Recognition
[AGARD-CP-290] N81-20803
Proceedings of the Beam-Beam Interaction Seminar
[SLAC-PUB-2624] N81-20856

CONFIDENCE LIMITS

Further development of new methods for estimating tail probabilities and extreme value distributions
[AD-A095721] N81-20794

CONFIGURATION INTERACTION

Atomic inner-shell processes
[AD-A095415] N81-20837

CONFIGURATION MANAGEMENT

Total system design methodology
[AD-A095727] N81-20054

CONFIGURATIONS

Study of interaction between solar arrays and attitude - orbit control. Volume 1: Technical Report
[ESS/SS-987-VOL-1] N81-20603

CONGRESSIONAL REPORTS

A look at NASA's Aircraft Energy Efficiency program
[PSAD-80-50] N81-20077

CONICAL BODIES

Computer Evaluation of Surface Topography (CEST) and applications to sheet steel finishing processes N81-20237

CONJUGATE POINTS

Geophysical investigations of the southern continental margin of Australia and the conjugate sector of East Antarctica N81-20832

CONSTRUCTION

Space platform advanced technology study
[NASA-CR-160934] N81-20146
A reference building approach to building energy performance standards for single-family residences
[PB81-135642] N81-20318

CONTAINERLESS MELTS

SPAR 6 experiment report containerless processing of glass experiment 74-42
[NASA-CR-161674] N81-20102

CONTAMINANTS

Polynuclear aromatic compounds. Synthesis and purification
[PB81-125015] N81-20182

CONTINENTAL SHELVES

Geophysical investigations of the southern continental margin of Australia and the conjugate sector of East Antarctica N81-20832

CONTINGENCY

Energy emergency contingency plan
[PB81-128704] N81-20604
Ranking various classifications of the same data from ground truths and contingency tables --- for the reduction of multispectral band scanner image data
[ESA-CR(P)-1388] N81-20766

CONTINUITY (MATHEMATICS)

Continuity of the optimal value function under the Mangasarian-Fromovitz Constraint Qualification
[AD-A095422] N81-20900

CONTRACTION
Study on contraction and relaxation of experimentally denervated and immobilized muscles: Comparison with dystrophic muscles
[NASA-TM-76053] N81-20724
CONTROL
Introduction to Praxis
[UCRL-52957-REV-1] N81-20753
CONTROL CONFIGURED VEHICLES
Integrated Application of Active Controls (IAAC) technology to an advanced subsonic transport: Project plan
[NASA-CR-3305] N81-20062
CONTROL THEORY
Modifications to the Flexible Spacecraft Dynamics Program
[NASA-CR-166655] N81-20166
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 2, appendix A: Selected DSG technologies and their general control requirements
[NASA-CR-164052] N81-20539
The reduced order model problem in distributed parameter systems adaptive identification and control --- adaptive control of flexible spacecraft
[NASA-CR-164059] N81-20761
CONTROLLED ATMOSPHERES
Lightside atmospheric revitalization system
[NASA-CR-160897] N81-20731
CONTROLLED FUSION
Accelerator development for heavy ion fusion
[LA-UR-80-2822] N81-20859
Research during 1979 in plasma physics and controlled fusion
[TRITA-PFU-80-01] N81-20890
Formation of compact toroidal plasmas by magnetized coaxial plasma gun injection into an oblate flux conserver
[UCRL-85122] N81-20895
Physical properties of compact toroids generated by a coaxial source
[LA-UR-80-3238] N81-20896
Fusion studies program
[DOE/ET-52025/3] N81-20906
Neutron spectra from beam-heated fusion plasmas. Research and Training Program on Controlled Thermonuclear Fusion and Plasma Physics (EUR-NE)
[TRITA-PFU-80-09] N81-20910
CONTROLLERS
Controller for computer control of brushless dc motors --- automobile engines
[NASA-CASE-NPO-13970-1] N81-20352
CONVECTION
Research of the state of convection in the Earth's mantle
[NASA-CR-163989] N81-20639
Mixing, convection, and advection in the upper ocean N81-20684
Time-dependent convection N81-20993
CONVECTIVE FLOW
Experimental and theoretical investigations on the influence of shear in double diffusive convection N81-20376
CONVERGENCE
Upper-bound solutions to flow through conical converging dies --- metal forming
[DOE/ER-10367/T3] N81-20400
A general dynamic synthesis for complex structures composed of substructures N81-20455
COOLANTS
Study of heat rejection systems --- space shuttle radiator using freon
[TC-80-TR-0054] N81-20165
COOLING
Dual nozzle aerodynamic and cooling analysis study
[NASA-CR-161677] N81-20175
Heat loss modeling for the ANL Research Solar Pond
[ANL-CT-80-22] N81-20589
COORDINATE TRANSFORMATIONS
Space and time reference systems N81-20111
Extrapolation of orbits N81-20114
A three-dimensional turbulent compressible subsonic duct flow analysis for use with constructed coordinate systems
[NASA-CR-3389] N81-20383
COORDINATES
Numerical solution of three-dimensional Navier-Stokes equations on an arbitrarily shaped body using a locally one-dimensional scheme N81-20023
COPOLYMERS
Fourier transform infrared spectroscopic studies on the thermal degradation of polyacrylonitrile copolymers
[AD-A095270] N81-20277
COPPER OXIDES
Investigation of solar cells based on Cu20
[DOE/ET-23006/4] N81-20593
CORRECTION
Geostationary satellite stationkeeping: Orbit correction strategies N81-20129
The correction for spectral mismatch effects on the calibration of a solar cell when using a solar simulator
[NASA-CR-164074] N81-20546
CORRELATION
General reflections --- on spacecraft motion and its influence on the geometric quality of imagery N81-20500
CORRELATION COEFFICIENTS
Daily surface pressure variations in Brazil: Their spatial distributions, origins and effects
[INPE-1974-RPE/279] N81-20659
CORROSION
A continuous corrosivity monitoring device for naval environments
[AD-A095728] N81-20250
Platelet mechanism of erosion of ductile metals
[LBL-11341-REV] N81-20261
CORROSION PREVENTION
Corrosion control through a better understanding of the metallic substrate/organic coating/interface
[AD-A095420] N81-20252
Determination of the effect of composition structure and electrochemical mass transport properties on adhesion and corrosion inhibition of paint films
[AD-A095293] N81-20278
CORROSION RESISTANCE
Passivation of carbon steel through mercury implantation
[NASA-CR-165292] N81-20244
CORROSION TESTS
Long time corrosion testing with and without mechanical stress of high temperature alloys for the blades of high output land-based gas turbines
[BMFT-FB-T-79-106] N81-20266
CORTICOSTEROIDS
The role of ACTH and glucocorticoids in nonenzymatic fibrinolysis during immobilization stress in animals
[NASA-TM-76175] N81-20693
COSMIC GASES
Consistency of the standard model of primordial nucleosynthesis: Response to the comment of Olive and Turner
[NASA-TM-82082] N81-20994
COSMIC RAYS
Early harvest: The upper atmosphere and cosmic rays N81-20968
COSMONAUTS
Program for the medical examination (consultation) of cosmonauts
[NASA-TM-76471] N81-20714
COSMOS SATELLITES
Islet in weightlessness: Biological experiments on board COSMOS 1129 satellite
[NASA-TM-76396] N81-20692
Preliminary results of scientific research on biosatellite Kosmos-1129
[NASA-TM-76287] N81-20700
COST ANALYSIS
The F/A-18 Naval Strike Fighter: Progress has been made but problems and concerns continue
[AD-A095287] N81-20069
Analysis of costs of gallium arsenide and silicon solar arrays for space power applications
[NASA-TP-1811] N81-20173
Coal preparation using magnetic separation. Volume 5: Evaluation of magnetic coal desulfurization concepts
[EPRI-CS-1517-VOL-5] N81-20302
Satellite Power Systems (SPS) concept definition study (Exhibit D). Volume 6, part 1: Cost and Programmatics
[NASA-CR-3397] N81-20537
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 5, appendix D: Cost-benefit considerations for providing dispersed storage and generation for electric utilities
[NASA-CR-164053] N81-20542
A method to tune the various components of a solar heating system --- economic factors and cost analysis N81-20552
Solar collector foundation designs
[SAND-80-7070] N81-20582
Optimal linear approximation in project compression
[AD-A095757] N81-20799
COST EFFECTIVENESS
Cost/performance of solar reflective surfaces for parabolic dish concentrators
[NASA-CR-164088] N81-20547
COST REDUCTION
Materials for opto-electronic devices --- fabrication of doped GaAs and GaP materials
[BMFT-FB-T-80-026] N81-20940
COUETTE FLOW
Stability of rotational Couette flow of density stratified fluids N81-20380
COULOMB POTENTIAL
Two-centre Coulomb phaseshifts and radial functions
[IPPJ-AM-16] N81-20888
COUNTER-ROTATING WHEELS
Actuators --- for spacecraft applications N81-20121
COUPLERS
Stress analysis of aircraft modifications (C-141B Aircraft). Joint Airborne Communications Center/Command Post (JACC/CP) provisions
[AD-A095634] N81-20072
COVARIANCE
On a class of multivariate exponential densities N81-20786
CRACK GEOMETRY
Application of the line-spring model to a cylindrical shell containing a circumferential or axial part-through crack N81-20464
CRACK PROPAGATION
Deformation microstructure developed during fatigue crack propagation in type 316 stainless steel at 593 deg C
[AD-A095387] N81-20246
Crack propagation in electron beam welded Ti-6Al-4 under spectrum loading conditions
[AD-A095585] N81-20467
Fracture mechanics and dynamic response of structures
[AD-A095272] N81-20469
Dynamic piping fracture coupled with system effects
[EPRI-NP-1640] N81-20470
Damage tolerance of hybrid structures --- crack propagation in aluminum alloy sheet reinforced by four unidirectional fiber/epoxy strips
[BMVG-FBWT-79-27] N81-20477
Acoustic emission. Flaw relationship for in-service monitoring of nuclear pressure vessels
[PNL-SA-8691] N81-20834
CRACKING (FRACTURING)
MHD air heater development technology
[DOE/ET-15602/T2] N81-20590
CRACKS
A study of flame spreading and combustion processes in solid propellant cracks N81-20214
Ultrasonic Materials Characterization
[PB81-124984] N81-20412
Defects in galvanized products. An inspection guide
[PB81-123671] N81-20452
The effects of repair patches on the stress distribution in a cracked sheet --- models of rectangular and square patches
[RAE-TR-80098] N81-20480
CREEP ANALYSIS
Simultaneous stress relaxation in tension and creep in torsion of 2618 aluminum at elevated temperature
[AD-A095410] N81-20248
Transient analysis of vibrations in nonideal multilayered piezoelectric devices
[SAND-80-1909] N81-20937
CREEP PROPERTIES
The motion of macromolecules and immiscible drops in creeping flow N81-20274

Life prediction methods for the combined creep-fatigue endurance
[ND-R-471(R)] N81-20471
Diffusional creep of multicomponent systems
[COO-2296-22] N81-20474
Development of an irradiation creep correlation for 20% cold-worked AISI 316 in fusion environments: DAFS contribution
[DOE/FF-02170/T58] N81-20475
High temperature properties of different SiC materials: Creep behavior
[BMFT-FB-T-79-157] N81-20478

CREEP RUPTURE STRENGTH
Examination of the strength of high temperature alloys for gas turbines in hot gas environments
[BMFT-FB-T-79-150] N81-20267

CREEP TESTS
High temperature properties of different SiC materials: Creep behavior
[BMFT-FB-T-79-157] N81-20478

CREVASSES
Radar investigations of the Ross Ice Shelf N81-20631

CRITICAL LOADING
Dynamic stability of structural elements subjected to step loads N81-20459

CROP GROWTH
Fundamentals of remote sensing relations between spectral signatures and physical properties of crops
[NLR-MP-79035-U] N81-20527

CRUCIFORM WINGS
The influence of roll orientation-dependent aerodynamics on the stability of cruciform missile configurations
[AD-A095269] N81-20151

CRUDE OIL
Classification of petroleum samples from gas chromatographic data by pattern recognition techniques and simulation of mass spectra by regression analysis of structural descriptors N81-20202

CRUISING FLIGHT
Application of linear quadratic control in reduction of aerodynamic forces on aircraft N81-20061

CRYOGENIC EQUIPMENT
Catalog of French cold gas equipment for use in space applications
[CNES-CT/PRT/SST/SE/349] N81-20313

CRYOGENIC FLUID STORAGE
Development and validation of cryogenic foam insulation for LH2 subsonic transports
[NASA-CR-3404] N81-20312

CRYOGENIC MAGNETS
Mirror fusion test facility magnet system
[UCRL-52955] N81-20904

CRYSTAL DEFECTS
Crystal defects in large scale integrated circuits of silicon --- and implications for crystal growth process control
[BMFT-FB-T-79-156] N81-20369
Numerical studies of transport quantities in one- and two-dimensional disordered systems N81-20915
The role of positional disorder in ferroelectric relaxors N81-20923
Fluxoid pinning by planar defects in Pb-Bi alloy films N81-20927

CRYSTAL DISLOCATIONS
Diffusional creep of multicomponent systems
[COO-2296-22] N81-20474
Ultrasonic attenuation in normal and superconducting indium N81-20918

CRYSTAL GROWTH
SPAR 6 experiment report containerless processing of glass experiment 74-42
[NASA-CR-161674] N81-20102
Structural and thermodynamic properties of xenon, krypton, and argon adsorbed on silver(111) N81-20924
A feasibility study on the growth of bulk GaN single crystals
[AD-A095553] N81-20932

CRYSTAL LATTICES
Numerical studies of transport quantities in one- and two-dimensional disordered systems N81-20915
A heat pulse study of superconducting lead/indium alloys N81-20921
The role of positional disorder in ferroelectric relaxors N81-20923
A strong coupled electron-acoustic phonon system in one dimension N81-20925

CRYSTAL STRUCTURE
Microstructure and properties of A15 superconductors formed by direct precipitation
[LBL-11605] N81-20367
Superstructure phonons and their characterization by Raman Spectroscopy --- zincblende and metal oxides N81-20929
Experimental and theoretical studies of donor-type graphite intercalated compounds
[AD-A095282] N81-20935
Microstructure and properties of step aged rare Earth alloy magnets
[LBL-11680] N81-20938

CRYSTALLIZATION
The retardation of crystallization of CVD amorphous silicon and the study of its structural and optical properties N81-20912

CRYSTALS
Laser spectroscopy: Rare-earth crystals and crystals in solution N81-20913

CUES
Pilot training N81-20093
Physiological factors N81-20094
Simulation technology N81-20095
Conclusions and recommendations --- training simulator requirements and objectives N81-20096
Evaluation of a realtime prototype automatic target cuer N81-20823

CUMULATIVE DAMAGE
Identification of jet engine damages by engine trend analysis LEADS 200 data N81-20014

CURIE TEMPERATURE
Radiation effects in amorphous metallic alloys
[DOE/ET-10571/3] N81-20264

CURING
Calculation of the room-temperature shapes of unsymmetric laminates
[NASA-CR-163993] N81-20184

CURRENT DENSITY
The calculation of the current-gain of bipolar transistors and the theory for the forward-biased p-n junction at all injection levels N81-20354
Three-axis electron-beam test facility
[NASA-TP-1836] N81-20359

CURRENT DISTRIBUTION
About the parametric interplay between ionic Mach number, body-size and satellite potential in determining the ion depletion in the wake of the S3-2 satellite
[AD-A095507] N81-20149
Current sheet model N81-20331
Sausage mode stability boundaries: Enumeration and verification
[UCID-18879] N81-20851

CURRENT SHEETS
Fine-scale characteristics of interplanetary sector
[NASA-TM-82281] N81-20997

CURVED BEAMS
Energization of electrons in a plasma beam entering a curved magnetic field
[TRITA-EPP-80-09] N81-20909

CYBERNETICS
The reduced order model problem in distributed parameter systems adaptive identification and control --- adaptive control of flexible spacecraft
[NASA-CR-164059] N81-20761

CYCLES
A proof of the existence of unstable periodic orbits using computer-based techniques N81-20770

CYCLIC ACCELERATORS
FASTBUS system used in a high energy experiment
[BNL-28613] N81-20855

CYCLIC LOADS
Determination of load sequence effects on the degradation and failure of composite materials --- Graphite-epoxy composites
[NASA-CR-164065] N81-20186
Time-average optical methods for strain analysis N81-20453
Cyclic inelastic buckling of tubular steel braces
[PB81-124885] N81-20484

CYCLOGENESIS
The President's Day cyclone 17-19 February 1979: An analysis of jet streak interactions prior to cyclogenesis
[NASA-TM-82077] N81-20658

CYCLONES
Upper tropospheric cyclonic vortices in the tropical South Atlantic
[INPE-1946-RPE/263] N81-20660

CYCLOTRON FREQUENCY
Ion heating in the ion cyclotron range of frequencies in the Wisconsin Tokapole 2 N81-20880

CYCLOTRON RESONANCE DEVICES
Self-consistent nonlinear slow-time scale formulation and simulation of overmoded gyrotron oscillators and amplifiers
[AD-A095380] N81-20361

CYLINDRICAL BODIES
High speed cylindrical roller bearing development
[AD-A095357] N81-20437
Analysis of an assemblage of discs employing interactive graphics
[AD-A095735] N81-20750

CYLINDRICAL SHELLS
Application of the line-spring model to a cylindrical shell containing a circumferential or axial part-through crack N81-20464

CYLINDRICAL WAVES
A FORTRAN computer program for calculating the propagation of plane, cylindrical or spherical finite amplitude waves
[AD-A095386] N81-20832

D

D LINES
Average nocturnal and seasonal variations of sodium nightglow at 23 deg S, 46 deg W
[INPE-1957-RPE/271] N81-20634

D REGION
Measurements of possible D- and E-region telecommunications effects during ionospheric heating --- solar power satellite
[DOE/ER-10161/1] N81-20349
D-region electron density measurements obtained by partial reflection techniques
[AD-A095566] N81-20644

DAMAGE
Evaluation of the behavior of structures made of high modulus composite materials when struck by lightning
[NASA-TM-75866] N81-20188

DAMAGE ASSESSMENT
Life prediction methods for the combined creep-fatigue endurance
[ND-R-471(R)] N81-20471

DAMPING
Comments on settling chamber design for quiet, blowdown wind tunnels
[NASA-TM-81948] N81-20085

DAMS
Dynamic test of an arch dam using a laser light vibration sensor
[CISE-1576] N81-20482

DATA ACQUISITION
Investigation of Flight Test Methods for measuring the performance of general aviation aircraft
[NASA-CR-164057] N81-20065
Applications of microcomputers to spectroscopy and electrochemistry N81-20209
Mobile digital data acquisition and recording system for geoenergy process monitoring and control
[SAND-80-2123] N81-20584
International seismological data center: Procedures to check events through dynamic information and to estimate magnitudes --- monitoring for the nuclear test ban treaty
[FOA-C-20368-T1] N81-20648
A mathematical model for how ionospheric reflection degrades sea-echo spectra
[PB81-108359] N81-20652
Balloon Electrical Environment Profiling System (BEEPS)
[AD-A095531] N81-20669
FASTBUS system used in a high energy experiment
[BNL-28613] N81-20855

DATA BASES
Study of materials performance model for aircraft interiors
[NASA-CR-152378] N81-20063
Fundamental understanding of matter: An engineering viewpoint
[LA-UR-80-3585] N81-20181
Residential solar data center MIRADS user's guide
[PB81-132268] N81-20606
Performance analysis of distributed database systems N81-20734

Control of database access and integrity in cellular-logic devices N81-20735
Advanced Query Facility
[AD-A095717] N81-20950
Defense Technical Information Center referral data bank directory, Edition No. 8
[AD-A095600] N81-20952
Modular file-structured databasing system
[SAND-80-2336C] N81-20953
Data bases available at the National Bureau of Standards library
[PB81-132870] N81-20955

DATA COMPRESSION
Optimal linear approximation in project compression
[AD-A095757] N81-20799
Image processing techniques using spline approximation N81-20809

DATA CORRELATION
Numerical target tracking N81-20817

DATA MANAGEMENT
Standard software base release 3 --- communication systems applications
[AD-A095693] N81-20749

DATA PROCESSING
flight data recording and data processing for light airplanes and gliders N81-20008
A quick-look system for the processing of flight data recordings N81-20021
Flight tests of the microwave landing system multimode digital processor
[AD-A095449] N81-20056
Environmetrics of synfuels. 1: Processing the automated PDP-11 data components for the UMD gasifier facility
[ORNL/TM-7428] N81-20305
Digital processing of remotely sensed images
[NASA-SP-431] N81-20489
ICAP: An Interactive Cluster Analysis Procedure for analyzing remotely sensed data --- to classify the radiance data to produce a thematic map
[NASA-TM-80732] N81-20494
Summary of the western energy overhead monitoring project
[PB81-129009] N81-20531
Logical channel theory
[AD-A095663] N81-20737
The Data from Aeromechanics Test and Analytics, Management and Analysis Package (DATAMAP). Volume 1: User's manual
[AD-A095188] N81-20745
Modularity in non-procedural languages through abstract data types
[AD-A095546] N81-20748
Data format translation routines
[ORNL/CSD/TM-137] N81-20752
On bounds for the specification of finite data types by means of equations and conditional equations --- algebraic data types
[MC-IW-131/80] N81-20781
Image and Sensor Data Processing for Target Acquisition and Recognition
[AGARD-CP-290] N81-20803
Memory, meaning and syntax
[AD-A095451] N81-20951

DATA PROCESSING EQUIPMENT
Dimensions/NBS. Volume 64, no. 8, October 1980
[PB81-133654] N81-21007

DATA RECORDERS
Individual jet engine stress load monitoring with the aid of the flight data recording system LEADS 200 N81-20013
Identification of jet engine damages by engine trend analysis LEADS 200 data N81-20014

DATA RECORDING
Digital filtering of PCM-recorded flight data for wind-processing N81-20009

DATA REDUCTION
On the use of AIDS-data for a statistical analysis of wind shear during the approach N81-20010
LORI: A multisatellite, multisystem, time-coverage analysis program
[AD-A095537] N81-20148
Processing radiometric data for cartography N81-20518
A statistical data analysis and plotting program for cloud microphysics experiments
[NASA-CR-161663] N81-20665
Ranking various classifications of the same data from ground truths and contingency tables --- for the reduction of multispectral band scanner image data
[ESA-CR(P)-1388] N81-20766

DATA RETRIEVAL
A technique for recovering nonsynchronized data from a digital flight data recorder N81-20020
Conceptual information retrieval
[AD-A095372] N81-20765
Materials data retrieval at ESTEC --- for spacecraft construction
[ESA-STM-206] N81-20954

DATA SAMPLING
Hot wire techniques: Conditional sampling and intermittency --- measurement of turbulent flows N81-20393

DATA SYSTEMS
On contributions to the 10th Symposium on Aircraft Integrated Data Systems (AIDS) --- Aachen, 26-27 Mar. 1980
[DFVLR-MITT-80-09] N81-20007
Uses of AIDS data in airlines engine maintenance N81-20016
The A310 Aircraft Integrated Data System (AIDS) N81-20017
Possible online uses of AIDS data in future ATC systems N81-20018
Shuttle/payload communications and data systems interface analysis
[NASA-CR-160929] N81-20157
Shuttle/payload communications and data systems interface analysis: Executive summary
[NASA-CR-160929] N81-20158
Shuttle/payload communications and data systems interface analysis: Introduction N81-20159
Payload/orbiter signal processing and data handling system evaluation presentation N81-20160
Preliminary interface revision notice SD-152C update of section 8.3 of ICD 2-19001 for detached payloads N81-20163
Control of database access and integrity in cellular-logic devices N81-20735

DATA TRANSMISSION
Bounds on transmission delays for the CCRA --- Capetanakis collision resolution protocol
[AD-A095658] N81-20346

DEATH
Pathogenesis of sudden death following water immersion (immersion syndrome)
[NASA-TM-76542] N81-20723

DECAY
Quark and gluon decay functions in QCD and recombination model
[DOE/ER-70004/266] N81-20845

DECAY RATES
FASTBUS system used in a high energy experiment
[BNL-28613] N81-20855

DECISION MAKING
Distributed routing
[AD-A095385] N81-20762

DECISIONS
Aspects of symmetric Bayesian sequential decision problems N81-20789

DEEP SPACE NETWORK
The Deep Space Network: An instrument for radio science research
[NASA-CR-164077] N81-20339

DEFECTS
Ultrasonic Materials Characterization
[PB81-124984] N81-20412
Acoustic emission. Flaw relationship for in-service monitoring of nuclear pressure vessels
[PNL-SA-8691] N81-20834

DEFENSE PROGRAM
The development of synthetic fuels: Department of Defense logistics implications
[AD-A095713] N81-20290
Defense Technical Information Center referral data bank directory, Edition No. 8
[AD-A095600] N81-20952
External relations N81-20971

DEFORMATION
Some effects of thermal-cycle-induced deformation in rocket thrust chambers
[NASA-TP-1834] N81-20176
The deformation of grains during cold-rolling N81-20238
Deformation microstructure developed during fatigue crack propagation in type 316 stainless steel at 593 deg C
[AD-A095387] N81-20246
A strong coupled electron-acoustic phonon system in one dimension N81-20925

DEGRADATION
Kinetics of the degradation of type 316 stainless steel by liquid lithium N81-20239
Degradation of the surface finish of the SPACELAB pallet after ultraviolet irradiation --- paints
[ESA-STM-215] N81-20284
Radiometric degradation of images and ground preprocessing --- of imagery received from remote sensors N81-20513

DELAMINATING
Experimental studies of the delamination mechanisms in impacted fiber-reinforced composite plates N81-20183

DELAY
Bounds on transmission delays for the CCRA --- Capetanakis collision resolution protocol
[AD-A095658] N81-20346

DELTA MODULATION
The effect of interference on delta modulation encoded video signals
[NASA-CR-160923] N81-20324

DELTA WINGS
Leading edge devices on slender wings --- wind tunnel tests of delta wings
[BU-250] N81-20041

DEMOGRAPHY
Global future: Time to act. Report to the President on global resources, environment and population N81-20957

DENSITY (MASS/VOLUME)
Stability of rotational Couette flow of density stratified fluids N81-20380

DENSITY MEASUREMENT
Density measurement in air with a saturable absorbing seed gas
[NASA-CR-164063] N81-20641
Balloonborne lidar experiment --- atmospheric density measurements
[AD-A095366] N81-20642
Plasma fluctuation measurements in ELMO Bumpy Torus
[ORNL/TM-7530] N81-20898

DEPENDENCE
Tests for dependence in multivariate observations N81-20788

DEPOLYMERIZATION
The effect of oxygen and anthraquinone on the alkaline depolymerization of amylose N81-20272

DEPOSITION
Diagnostic system design for the Ion Auxiliary Propulsion System (IAPS). Flight tests of two 8 cm mercury ion
[NASA-TM-81702] N81-20172

DESCRIPTIVE GEOMETRY
Cartography --- generalities on the compilation of maps N81-20498
Geometrical correction of images: Methods and performance N81-20517

DESIGN ANALYSIS
Pilot training N81-20093
Shuttle orbiter Ku-band radar/communications system design evaluation
[NASA-CR-160898] N81-20327
Steam turbines for large power outputs --- conference, Belgium, 11-15 Feb. 1980
[VKI-LS-1980-6] N81-20426
Steam turbines for large power outputs N81-20427
Design of nonrotating parts --- in steam turbines N81-20428
Large wind energy converter: Growian 3 MW
[NASA-TM-75404] N81-20543
Building thermal loads calculations N81-20557
The design study of a far infrared heterodyne spectrometer assembly, volume 1 --- spaceborne applications
[ESS/CCG-118-VOL-1] N81-20989
The design study of a far infrared heterodyne spectrometer assembly, volume 2 --- power conditioner
[ESS/CCG-118-VOL-2] N81-20990

DESORPTION
Kinetics of hydrogen absorption-desorption by metals
[BNL-28584] N81-20259
Theoretical studies of atom surface interactions
[AD-A095341] N81-20839

DESTRUCTIVE TESTS
Flexure tests of three fibrous composite materials
[FFA-TN-HU-2127-PT-3] N81-20192

DESULFURIZING
Coal preparation using magnetic separation. Volume 5: Evaluation of magnetic coal desulfurization concepts
[EPRI-CS-1517-VOL-5] N81-20302

DETECTION
Evaluation of national SAR manual: Probability of detection curves
[AD-A095748] N81-20048
Detection of water induction in steam turbines
[EPRI-CS-1604] N81-20438

DETONATION
Effect of additives on the lean detonation limit of kerosene sprays in air
[AD-A095190] N81-20221
Numerical calculation of shock-induced initiation of detonations
[LA-UR-80-2854] N81-20303
Fast detonator-activated ball shutter for high explosive experiments
[UCID-18814] N81-20409

DIAGNOSIS
Development of combustion diagnostics and application to turbulent combustion
[AD-A095719] N81-20219

DIATOMIC MOLECULES
Two-centre Coulomb phaseshifts and radial functions
[IPPJ-AM-16] N81-20888

DIELECTRICS
High voltage research (breakdown strengths of gaseous and liquid insulators) and environmental effects of dielectric gases --- halogenated ethylene compounds
[ORNL/TM-7624] N81-20366

DIES
Die casting
[PB81-123697] N81-20314
Upper-bound solutions to flow through conical converging dies --- metal forming
[DOE/ER-10367/T3] N81-20400

DIESEL FUELS
Comparison of gas phase hydrocarbon emissions from light-duty gasoline vehicles and light-duty vehicles equipped with diesel engines
[PB81-122996] N81-20620

DIFFERENTIAL EQUATIONS
Guaranteed component-wise point-wise error bounds for approximate solutions of nonlinear two-point boundary value problems using an improved Kantorovich-like theorem N81-20740
Asymptotic boundary conditions for ordinary differential equations, 1. Numerical Hopf bifurcation, 2 N81-20768
Studies in nonlinear motion
[AD-A095559] N81-20777
New formulation of backward differenced linear multistep methods for ordinary differential equations
[UCID-18825] N81-20779

DIFFERENTIAL THERMAL ANALYSIS
Thermal lens calorimetry N81-20204
Characterization of the physico-chemical properties of polymeric materials for aerospace flight --- differential thermal and atomic absorption spectroscopic analysis of nickel cadmium batteries
[NASA-CR-164062] N81-20276
Advanced methods for preparation and characterization of infrared detector materials --- mercury cadmium tellurides
[NASA-CR-161598] N81-20863

DIFFRACTION PATTERNS
Phase control during reconstruction of holographically recorded flow fields using real-time holographic interferometry
[NASA-TM-81953] N81-20405
Heterodyne interferometric and moire test methods for surface measurements N81-20914

DIFFUSION
Determination of the effect of composition structure and electrochemical mass transport properties on adhesion and corrosion inhibition of paint films
[AD-A095293] N81-20278
Experimental and theoretical investigations on the influence of shear in double diffusive convection N81-20376
A unified theory of linear diffusion in multilayered materials N81-20381

DIFFUSION WELDING
Cermet-bonded metal pins for weldable electrical feedthroughs in alumina
[MLM-2796(OP)] N81-20279

DIGITAL DATA
A technique for recovering nonsynchronized data from a digital flight data recorder N81-20020
Mobile digital data acquisition and recording system for geoenergy process monitoring and control
[SAND-80-2123] N81-20584
Digital image processing for ground target detection, identification and location N81-20824

DIGITAL FILTERS
Digital filtering of PCM-recorded flight data for wind-processing N81-20009
Image restoration parameter choice: A quantitative guide
[AD-A095708] N81-20446

DIGITAL SYSTEMS
Experiences with flight recorders obtained by analyzing aircraft accidents N81-20019
Flight tests of the microwave landing system multimode digital processor
[AD-A095449] N81-20056
Digital processing of remotely sensed images
[NASA-SP-431] N81-20489

DIGITAL TECHNIQUES
Quantitative ion microscopy by digital image processing N81-20205
Hardware implementations of Fourier Transform signal processing
[PB81-123200] N81-20351
The localization of reference points --- on images and associated digital methodology N81-20514

DIRECT CURRENT
Controller for computer control of brushless dc motors --- automobile engines
[NASA-CASE-NPO-13970-1] N81-20352

DISCRIMINATION
An asymptotic expansion for the distribution of the location linear discriminant function
[MATH-RES-149] N81-20784

DISEASES
Study on contraction and relaxation of experimentally denervated and immobilized muscles: Comparison with dystrophic muscles
[NASA-TM-76053] N81-20724

DISK GALAXIES
Virgo cluster galaxies: Neutral hydrogen studies N81-20991

DISKS
Concept definition: Retirement for cause of F-100 rotor components
[AD-A095584] N81-20080

DISKS (SHAPES)
Analysis of an assemblage of discs employing interactive graphics
[AD-A095735] N81-20750

DISLOCATIONS (MATERIALS)
Mechanism of work hardening in Hadfield manganese steel N81-20243

DISPERSING
A study of dispersion processes and climatology from the TWERL Balloon experiment N81-20022
Mathematical models for dispersion of chromatographic solute bands N81-20194

DISPERSIONS
Dynamics of solid dispersions in oil during the lubrication of point of contacts. Part 2: Molybdenum disulfide
[NASA-TM-81709] N81-20275

DISPLACEMENT
Time-average optical methods for strain analysis N81-20453

DISPLAY DEVICES
A pilot training manual for the terminal configured vehicle electronic horizontal situation indicator
[NASA-TM-81959] N81-20044
Mobile digital data acquisition and recording system for geoenergy process monitoring and control
[SAND-80-2123] N81-20584
Real-time grey-level histogram manipulation N81-20807
Flat display panel in liquid crystal technology
[BMFT-FB-T-80-012] N81-20876

DISTILLATION
Ultrapure metals preparation in space
[NASA-CR-161678] N81-20101

DISTORTION
Models of deformation --- introduced by the transformation of terrain coordinates into image coordinates N81-20515

DISTRIBUTION (PROPERTY)
Optimal distribution of thermal insulation and ground heat losses
[PB81-122871] N81-20317

DISTRIBUTION FUNCTIONS
An asymptotic expansion for the distribution of the location linear discriminant function
[MATH-RES-149] N81-20784
A Monte Carlo comparison of robust and resistant estimators of bivariate correlation N81-20785
On a class of multivariate negative binomial distributions
[AD-A095445] N81-20793

DIURNAL VARIATIONS
New observations on the daily variations of natural ice albedo
[PB81-132789] N81-20532

DOPES
Raman spectra of highly conducting poly-p-phenylene complexes
[AD-A095660] N81-20218

DOPPLER EFFECT
The Deep Space Network: An instrument for radio science research
[NASA-CR-164077] N81-20339
Noninvasive aortic bloodflow by Pulsed Doppler Echocardiography (PDE) compared to cardiac output by the direct Fick procedure N81-20709
Beat by beat stroke volume assessment by PDE in upright and supine exercise N81-20710
Instantaneous stroke volume by PDE during and after constant LBNP (-50 torr) N81-20711

DOPPLER RADAR
A mathematical model for how ionospheric reflection degrades sea-echo spectra
[PB81-108359] N81-20652
Analysis of the inversion monitoring capabilities of a monostatic acoustic radar in complex terrain --- Tennessee River Valley
[NASA-CR-3401] N81-20664

DRILLING
Critically loaded hole technology pilot collaborative test programme
[AGARD-R-678] N81-20461

DROP SIZE
The motion of macromolecules and immiscible drops in creeping flow N81-20274
Fog characteristics at Otis AFB, Massachusetts
[AD-A095358] N81-20676

DROPS (LIQUIDS)
Investigation into the behavior of titanium and titanium alloys under cavitational stress --- droplet impinger
[GEC-TRANS-2071] N81-20265

DRUGS
Laser fluorescence detection for high performance liquid chromatography N81-20207

DUAL THRUST NOZZLES
Dual nozzle aerodynamic and cooling analysis study
[NASA-CR-161677] N81-20175

DUCTED FLOW
A three-dimensional turbulent compressible subsonic duct flow analysis for use with constructed coordinate systems
[NASA-CR-3389] N81-20383

DUCTILITY
Microscopic processes in the ductile fracture of precipitation hardened A1-1.79 W/O Cu alloys N81-20240

DUST
Explosibility of energetic material dusts
[AD-A095353] N81-20288

DUST COLLECTORS
Laser spectroscopy for the environment
[BMFT-FB-T-80-014] N81-20617

DYE LASERS
New techniques in atomic and molecular laser spectroscopy N81-20210
Laboratory tank studies of a single species of phytoplankton using a remote sensing fluorosensor [NASA-TP-1821] N81-20492
Laser spectroscopy: Rare-earth crystals and crystals in solution N81-20913
DYNAMIC CHARACTERISTICS
Evaluation of the behavior of structures made of high modulus composite materials when struck by lightning [NASA-TM-75866] N81-20188
Viscoelastic propellant effects on Space Shuttle Dynamics [NASA-TM-82403] N81-20289
Dynamics of cavitating cascades --- transfer functions [NASA-CR-161673] N81-20382
DYNAMIC LOADS
Further studies on magnus phenomena on spinning and coning bodies [AD-A095193] N81-20032
Fracture mechanics and dynamic response of structures [AD-A095272] N81-20469
DYNAMIC MODELS
Silent boundary methods for transient wave analysis N81-20378
Measurements and predictions of complex turbulent flows, volume 2 --- conference, Belgium, 11-15 Feb. 1980 [VKI-LS-1980-3-VOL-2] N81-20385
Turbulence transport models for numerical computation of complex turbulent flows N81-20386
DYNAMIC RESPONSE
A linearization technique for the dynamic response of nonlinear continuae N81-20456
Numerical procedure for predicting the torsional dynamic response of solid media N81-20460
A response spectrum method for random vibrations [PB81-122301] N81-20483
DYNAMIC STABILITY
Modifications to the Flexible Spacecraft Dynamics Program [NASA-CR-166655] N81-20166
Dynamic stability of structural elements subjected to step loads N81-20459
DYNAMIC STRUCTURAL ANALYSIS
A comparison of damping synthesis methods for space vehicle dynamic analysis [CNES-80/CT/PRT/SST/SM/316] N81-20171
Viscoelastic propellant effects on Space Shuttle Dynamics [NASA-TM-82403] N81-20289
Structural response and input identification [NASA-CR-164079] N81-20465
Category 1 structures: Safety margin at ultimate load [LA-UR-80-2858] N81-20472
The 3D solid element (type 4 - elastic or elastic-perfectly-plastic) for the ANSR-11 program --- nonlinear structural response [PB81-123242] N81-20485
DYNAMIC TESTS
Support interference of wind tunnel models: A selective annotated bibliography [NASA-TM-81909] N81-20084
Dynamic test of an arch dam using a laser light vibration sensor [CISE-1576] N81-20482
DYSPROSIUM
Concepts and limitations of macroparticle accelerators using traveling magnetic waves [LA-UR-80-3507] N81-20860

E

E REGION
Measurements of possible D- and E-region telecommunications effects during ionospheric heating --- solar power satellite [DOE/ER-10161/1] N81-20349
EAR
Role of a decrease in body heat content in the thermoregulatory reaction of the concha auriculae vessels [NASA-TM-76370] N81-20717
Meniere's disease: A surgeon's tactics [NASA-TM-76398] N81-20719
EARTH ATMOSPHERE
A theoretical and experimental study on the atomic oxygen corona in the Earth's atmosphere N81-20624
A simple static photochemical transport model for application to the upper atmospheres of Earth, Mars and Venus [BMFT-FB-W-79-35] N81-20650
Prophets and pioneers of spaceflight N81-20965
Continuing harvest: The broadening field of space science N81-20982
EARTH AXIS
The equatorial latitude of auroral activity 1972 - 1977 --- dmsp satellite observation [PB81-132912] N81-20654
EARTH MANTLE
Research of the state of convection in the Earth's mantle [NASA-CR-163989] N81-20639
EARTH ORBITS
Analysis of costs of gallium arsenide and silicon solar arrays for space power applications [NASA-TP-1811] N81-20173
EARTH RESOURCES
Global future: Time to act. Report to the President on global resources, environment and population N81-20957
EARTH RESOURCES PROGRAM
Earth Resources: A continuing bibliography, issue 28 [NASA-SP-7041(28)] N81-20486
EARTH SURFACE
On the orbits used for Earth observation missions --- their parametrization and calculation N81-20502
Satellite limitations compared to mission requirements for Earth observation N81-20512
Experimental study to define developments for terrestrial solar cell generators [BMFT-FB-T-79-143] N81-20600
The optical contrast of land and sea targets N81-20804
EARTHQUAKES
Reflection and transmission of obliquely incident Rayleigh waves at a vertical discontinuity N81-20629
Evidence for fault asperities from systematic time-domain modeling of teleseimic waveforms N81-20630
ECCENTRIC ORBITS
Choice and acquisition of the SPOT satellite orbit N81-20131
ECHOCARDIOGRAPHY
Noninvasive aortic bloodflow by Pulsed Doppler Echocardiography (PDE) compared to cardiac output by the direct Fick procedure N81-20709
Beat by beat stroke volume assessment by PDE in upright and supine exercise N81-20710
Instantaneous stroke volume by PDE during and after constant LBNP (-50 torr) N81-20711
ECONOMIC ANALYSIS
Engineering study of pelleting waste paper for energy recovery [NZERDC-53] N81-20562
Study of the potential for cogeneration in Canada: Industrial steam turbines. Volume 2: Economic potential [NP-25187-VOL-2] N81-20564
ECONOMIC FACTORS
Thermomechanical solar power/electricity generation. Technico-economic problems and prospectives of development and application N81-20556
The a priori decision in solar energy and conservation economics N81-20558
A life-cycle model for solar heating system design and economic evaluation Michigan Economic Model for Solar Heating (MESH) N81-20559
EDDY CURRENTS
Synthesis of work concerning eddy current pendular nutation dampers. Application of theory to equipment qualification and verification on a spin simulator [CNES-78/CT/PRT/SST/SS/197] N81-20169
EDDY VISCOSITY
Oscillating grid turbulence, including the effects of rotation N81-20881
EFFECTIVE PERCEIVED NOISE LEVELS
NASA progress in aircraft noise prediction [NASA-TM-81915] N81-20830
EFFICIENCY
Aspects of efficiency robust estimation of location N81-20787
EGYPT
Analogs of Martian eolian features in southwestern Egypt N81-20640
EIGENVECTORS
Daily surface pressure variations in Brazil: Their spatial distributions, origins and effects [INPE-1974-RPE/279] N81-20659
ELASTIC BUCKLING
Buckling of a rectangular plate on an elastic foundation, compressed in two directions N81-20457
ELASTIC PROPERTIES
Effects of hydrogen on the elastic constants of vanadium and palladium single crystals N81-20242
Viscoelastic propellant effects on Space Shuttle Dynamics [NASA-TM-82403] N81-20289
ELASTIC SCATTERING
Scoring methods for implicit Monte Carlo radiation transport [UCID-18858] N81-20852
Charged-particle cross section data for fusion plasma applications [COO-2218-195] N81-20902
ELASTIC SHELLS
Coupled fluid structure interaction problems, the case of an elastic-plastic shell and an acoustic fluid N81-20379
ELASTOMERS
Toughening of epoxy resin by acrylic elastomer N81-20273
ELASTOPLASTICITY
Coupled fluid structure interaction problems, the case of an elastic-plastic shell and an acoustic fluid N81-20379
The 3D solid element (type 4 - elastic or elastic-perfectly-plastic) for the ANSR-11 program --- nonlinear structural response [PB81-123242] N81-20485
Reflection and transmission of obliquely incident Rayleigh waves at a vertical discontinuity N81-20629
ELECTRIC AUTOMOBILES
Verification and product-improved tests of the South Coast Technology R-1 electric rabbit [AD-A095303] N81-20959
ELECTRIC BATTERIES
Evaluation of battery converters based on 4.8-MW fuel cell demonstrator inverter [DOE/RA-26961/01] N81-20575
Development of zinc-bromine batteries for utility energy storage [DOE/ET-29345/21] N81-20591
ELECTRIC CORONA
A theoretical and experimental study on the atomic oxygen corona in the Earth's atmosphere N81-20624
Psychoacoustic evaluation of transmission line audible noise: Building attenuation effects, methodology comparison, and field study feasibility, volume 1 [DOE/RA-29323/1] N81-20833
ELECTRIC DISCHARGES
Analysis of the Lithium Sulfur Dioxide System at ultra-high rate discharges --- electrolytic cells [AD-A095549] N81-20365
ELECTRIC FIELD STRENGTH
Thundercloud local electric field intensification during the pre-breakdown phase of lightning --- time and space evolution N81-20657
ELECTRIC FIELDS
'Finite part' electric and magnetic stored energies for planar antennas [NASA-TM-81955] N81-20336
Electric fields in the magnetosphere --- plasma-electromagnetic interactions [TRITA-EPP-80-06] N81-20651
Solar wind energy and electric field transfer to the Earth's magnetosphere via magnetopause reconnection [INPE-1940-RPE/259] N81-21001
ELECTRIC GENERATORS
Wind generator network methodology and analysis N81-20356

Thermomechanical solar power/electricity generation. Technico-economic problems and prospectives of development and application N81-20556

ELECTRIC MOTORS
Controller for computer control of brushless dc motors --- automobile engines [NASA-CASE-NPO-13970-1] N81-20352

ELECTRIC NETWORKS
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG), volume 1 [NASA-CR-164051] N81-20538
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 3, appendix B: State of the art, trends, and potential growth of selected DSG technologies [NASA-CR-164054] N81-20540
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 4, appendix C: Identification from utility visits of present and future approaches to integration of DSG into distribution networks [NASA-CR-164055] N81-20541

ELECTRIC POTENTIAL
Improvement of the electrolytic process of hydrogen production [EUR-6764-FR] N81-20299
Theory of flux-flow voltage noise in type-2 superconductors N81-20920

ELECTRIC POWER PLANTS
High-reliability gas turbine combined-cycle development program, phase 1. Volume 2: Appendixes [EPRI-AP-1599-VOL-2] N81-20434
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG), volume 1 [NASA-CR-164051] N81-20538
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 3, appendix B: State of the art, trends, and potential growth of selected DSG technologies [NASA-CR-164054] N81-20540
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 4, appendix C: Identification from utility visits of present and future approaches to integration of DSG into distribution networks [NASA-CR-164055] N81-20541

ELECTRIC POWER SUPPLIES
Delta electrical load analysis C-141B JACC/CP Aircraft [AD-A095659] N81-20071
Highly efficient welding power supply [DOE/CS-40023/T1] N81-20441

ELECTRIC PROPULSION
Analysis of costs of gallium arsenide and silicon solar arrays for space power applications [NASA-TP-1811] N81-20173

ELECTRIC WELDING
Highly efficient welding power supply [DOE/CS-40023/T1] N81-20441

ELECTRICAL RESISTANCE
Conductivity as a tool for evaluating the homogeneity of sintered discs of transition metal oxides [AD-A095298] N81-20249

ELECTRICAL RESISTIVITY
Raman spectra of highly conducting poly-p-phenylene complexes [AD-A095660] N81-20218
Cermet-bonded metal pins for weldable electrical feedthroughs in alumina [MLM-2796(OP)] N81-20279
Electric conduction in n-type germanium and cadmium sulfide [INPE-1950-RPE/266] N81-20358
Monolithic integrated semiconductor switches with low on-resistance --- for private automatic branch exchange (PABX) applications [BMFT-FB-T-80-016] N81-20373
Balloon Electrical Environment Profiling System (BEEPS) [AD-A095531] N81-20669
Numerical studies of transport quantities in one- and two-dimensional disordered systems N81-20915
The electrical resistivity and the thermoelectric ratio of potassium and dilute potassium rubidium alloys below 1 K N81-20919

ELECTRO-OPTICAL PHOTOGRAPHY
Radiometric degradation of images and ground preprocessing --- of imagery received from remote sensors N81-20513
Solid state imagers --- imaging and image storage [BMFT-FB-T-80-009] N81-20875

ELECTROCHEMISTRY
Applications of microcomputers to spectroscopy and electrochemistry N81-20209
The generalized standard addition method: Intermetallic interferences in anodic stripping voltammetry [AD-A095419] N81-20222
Survey of electrochemical production of inorganic compounds --- production of synthetic fuels [ANL/OEPM-80-3] N81-20226
A continuous corrosivity monitoring device for naval environments [AD-A095728] N81-20250
Determination of the effect of composition structure and electrochemical mass transport properties on adhesion and corrosion inhibition of paint films [AD-A095293] N81-20278

ELECTRODEPOSITION
The microstructural and property changes of laser treated electrodeposits [AD-A095345] N81-20254

ELECTRODES
Improvement of the electrolytic process of hydrogen production [EUR-6764-FR] N81-20299
Silver-iron batteries [STU-78-4981] N81-20597
Electrode boundary layers in dense, diffuse plasmas [AD-A095250] N81-20892

ELECTRODIALYSIS
Technical and economic feasibility of membrane technology [DOE/CS-40213/T1] N81-20231

ELECTROLYSIS
Improvements in the electrolytic generation of hydrogen N81-20287
Improvement of the electrolytic process of hydrogen production [EUR-6764-FR] N81-20299

ELECTROLYTES
Characterization of the physico-chemical properties of polymeric materials for aerospace flight --- differential thermal and atomic absorption spectroscopic analysis of nickel cadmium batteries [NASA-CR-164062] N81-20276
Analysis of the Lithium Sulfur Dioxide System at ultra-high rate discharges --- electrolytic cells [AD-A095549] N81-20365

ELECTROLYTIC CELLS
A continuous corrosivity monitoring device for naval environments [AD-A095728] N81-20250
Analysis of the Lithium Sulfur Dioxide System at ultra-high rate discharges --- electrolytic cells [AD-A095549] N81-20365

ELECTROMAGNETIC ABSORPTION
New techniques in atomic and molecular laser spectroscopy N81-20210
Density measurement in air with a saturable absorbing seed gas [NASA-CR-164063] N81-20641
Absorption of laser radiation in a plasma with subcritical density [UCRL-TRANS-11633] N81-20905

ELECTROMAGNETIC FIELDS
Extension of Volterra analysis to weakly nonlinear electromagnetic field problems with application to whistler propagation --- cold collisionless electron plasma N81-20319
ULF/lower-ELF electromagnetic field measurements in the polar caps [AD-A095283] N81-20343
LASL Free Electron Laser experiment [LA-UR-80-3187] N81-20420
Development of a new noninvasive method to determine the integrity of bone in vivo [NASA-CR-160922] N81-20722

ELECTROMAGNETIC MEASUREMENT
The 1980 direct strike lightning data [NASA-TM-81946] N81-20668

ELECTROMAGNETIC NOISE
Theory of flux-flow voltage noise in type-2 superconductors N81-20920

ELECTROMAGNETIC SCATTERING
Electromagnetic scattering by open circular waveguides --- modeling jet engine inlets [AD-A095554] N81-20345

ELECTROMAGNETS
Magnetic bearing reaction wheel tests --- satellite applications [CNES-80/CT/PRT/SST/SS/162] N81-20444

ELECTROMECHANICAL DEVICES
An experimental device for measurement of the viscoelastic properties of thickened liquids [AD-A095396] N81-20225

ELECTRON ATTACHMENT
High voltage research (breakdown strengths of gaseous and liquid insulators) and environmental effects of dielectric gases --- halogenated ethylene compounds [ORNL/TM-7624] N81-20366

ELECTRON BEAM WELDING
Crack propagation in electron beam welded Ti-6Al-4 under spectrum loading conditions [AD-A095585] N81-20467

ELECTRON BEAMS
Three-axis electron-beam test facility [NASA-TP-1836] N81-20359
Self-consistent nonlinear slow-time scale formulation and simulation of overmoded gyrotron oscillators and amplifiers [AD-A095360] N81-20361
Design, fabrication and testing of a satellite electron beam system [AD-A095362] N81-20362
The 200 kV linear beam switch tube development [AD-A095505] N81-20363
Sausage mode stability boundaries: Enumeration and verification [UCID-18879] N81-20851
Electrode boundary layers in dense, diffuse plasmas [AD-A095250] N81-20892
Investigation of the production of high density uniform plasmas [AD-A095508] N81-20893

ELECTRON CAPTURE
Non-adiabatic capture of mobile electrons in aqueous solution [AD-A095524] N81-20836

ELECTRON DENSITY (CONCENTRATION)
The Deep Space Network: An instrument for radio science research [NASA-CR-164077] N81-20339
D-region electron density measurements obtained by partial reflection techniques [AD-A095566] N81-20644
Growth, characterization, and applications of gallium arsenide and germanium layers grown by molecular beam epitaxy N81-20926

ELECTRON ENERGY
LASL Free Electron Laser experiment [LA-UR-80-3187] N81-20420
One-dimensional space-charge neutralization of the ion beams [SAND-80-2545] N81-20844
Electron heating in a high voltage toroidal theta pinch N81-20884
Orbit averaged radial buildup code for tandem mirror geometry [UCID-18905] N81-20907
Energization of electrons in a plasma beam entering a curved magnetic field [TRITA-EPP-80-09] N81-20909

ELECTRON IMPACT
Study of the ionization of C, N, O, Nr, Kr and Xe positive ions by electron impact [ORNL-TR-4702] N81-20841

ELECTRON IRRADIATION
Radiation effects in amorphous metallic alloys [DOE/ET-10571/3] N81-20264

ELECTRON MICROSCOPY
Microscopic processes in the ductile fracture of precipitation hardened A1-1.79 W/O Cu alloys N81-20240

ELECTRON MOBILITY
Advanced theoretical methods for improving the performance of thermionic converters --- Boltzmann equation solutions [DOE/ET-15422/5] N81-20560

ELECTRON PHONON INTERACTIONS
A strong coupled electron-acoustic phonon system in one dimension N81-20925

ELECTRON PLASMA
Extension of Volterra analysis to weakly nonlinear electromagnetic field problems with application to whistler propagation --- cold collisionless electron plasma N81-20319
ELECTRON SCATTERING
Atomic collision theory
[AD-A095284] N81-20838
ELECTRON SPECTROSCOPY
The application of photoacoustic spectroscopy to electronic spectroscopy of crystalline solids N81-20196
ELECTRONIC EQUIPMENT TESTS
Testing aircraft instruments
[AD-A095680] N81-20075
Three-axis electron-beam test facility
[NASA-TP-1836] N81-20359
Design, fabrication and testing of a satellite electron beam system
[AD-A095362] N81-20362
ELECTRONIC PACKAGING
The design study of a far infrared heterodyne spectrometer assembly, volume 2 --- power conditioner
[ESS/CCG-118-VOL-2] N81-20990
ELECTRONYSTAGMOGRAPHY
Importance of photoelectronystagmography for clinical study of the vestibular function
[NASA-TM-76404] N81-20713
Objective appraisal of tolerance to ventriculography with various radiocontrast media (according to electronystagmography data)
[NASA-TM-76340] N81-20721
ELECTROPHOTOMETRY
The development and evaluation of an automated reflectance microscope system for the petrographic characterization of bituminous coals N81-20488
ELECTROPLATING
The high resolution imaging atom-probe with application to nickel platings
[AD-A095254] N81-20251
ELECTROSTATIC PROBES
Plasma fluctuation measurements in ELMO Bumpy Torus
[ORNL/TM-7530] N81-20898
ELECTROSTATIC PROPULSION
Free radical propulsion concept
[NASA-TM-81770] N81-20180
ELEMENTARY PARTICLE INTERACTIONS
Study of direct single photons and correlated particles in proton-proton collisions at square roots = 62-4 GeV (CCOR collaboration)
[DOE/ER-02232/94] N81-20842
ELIMINATION
Reactions of metal-metal multiple bonds. 8: Forming Mo-Mo quadruple bonds by reductive elimination (alkyl group disproportionation) in the reactions of 1,2-Mo2R2(NMe)4 compounds (M triple bond M) with carbon dioxide and 1,3-Diaryltriazenes
[AD-A095421] N81-20224
ELLIPTICAL ORBITS
Perturbed elliptical motion --- theory and application to calculating orbits around the Earth N81-20110
Orbit perturbations: The effects --- elliptical orbits N81-20113
ELLIPTICITY
Ideal MHD equilibrium of a weakly toroidal plasma column with elongated cross section. Part 2: Force-free fields
[REPT-80-124-PT-2] N81-20911
EMBEDDING
An application of the embedded grid technique to the calculation of transonic flow past wings --- Cartesian grids and programming
[FFA-TN-AU-1600] N81-20036
EMERGENCIES
Energy emergency contingency plan
[PB81-128704] N81-20604
EMISSION SPECTRA
Improved emission spectrographic facility
[DPSPU-80-30-7] N81-20228
Ultraviolet laser photochemistry of halogenated methanes
[LA-UR-80-2798] N81-20233
Non-adiabatic capture of mobile electrons in aqueous solution
[AD-A095524] N81-20836
EMULSIONS
Combustion of drops and sprays of heavy fuel oils and their emulsions
[AD-A095612] N81-20220
ENCAPSULATING
Ion implantation of krypton in sputter-deposited metal matrices --- storing krypton 85
[PNL-SA-8661] N81-20939
ENCLOSURES
Design, construction and testing of a dc bioeffects test enclosure for small animals --- simulating the environment of high voltage dc transmission lines
[DOE/RA-10157/1] N81-20702
ENERGETIC PARTICLES
Simulation studies of the stability of weak and strong ion layers and rings N81-20882
ENERGY
Marine biomass: Algae as source of energy
[NE/BIO-80/12] N81-20581
ENERGY ABSORPTION
Energization of electrons in a plasma beam entering a curved magnetic field
[TRITA-EPP-80-09] N81-20909
ENERGY BUDGETS
Determination of regional evapotranspiration using energy balance, planetary boundary layer transfer coefficients and regularly recorded data N81-20626
ENERGY CONSERVATION
Integrated Application of Active Controls (IAAC) technology to an advanced subsonic transport: Project plan
[NASA-CR-3305] N81-20062
Optimal distribution of thermal insulation and ground heat losses
[PB81-122871] N81-20317
The a priori decision in solar energy and conservation economics N81-20558
Study of the potential for cogeneration in Canada: Industrial steam turbines. Volume 1: Main report
[NP-25187-VOL-1] N81-20563
Energy conservation in houses built from 1960
[SIB-R-4-1980] N81-20569
Development of method and equipment for energy recovery from the exhaust gases of the oil-fueled smelting and holding furnaces
[STU-78-6895] N81-20573
Energy emergency contingency plan
[PB81-128704] N81-20604
ENERGY CONSUMPTION
Insert type milling cutter evaluation
[SAND-80-2185C] N81-20439
ENERGY CONVERSION
Coal conversion 1979 technical report
[DOE/FE-0010] N81-20297
Evaluation of battery converters based on 4.8-MW fuel cell demonstrator inverter
[DOE/RA-26961/01] N81-20575
ENERGY CONVERSION EFFICIENCY
Improvements in the electrolytic generation of hydrogen N81-20287
Review of fusion synfuels
[BNL-28627] N81-20300
LSA field test
[NASA-CR-164083] N81-20544
The 10-kilowatt photovoltaic concentrator array fabrication
[SAND-80-7062] N81-20599
ENERGY DISSIPATION
Heat loss modeling for the ANL Research Solar Pond
[ANL-CT-80-22] N81-20589
Correlation of aligned angular momentum with scattering angle and energy loss in deeply inelastic collisions
[DOE/ER-01388/464] N81-20840
ENERGY LEVELS
Single photon excimer laser photodissociation of highly vibrationally excited polyatomic molecules
[LA-UR-80-3459] N81-20847
Perturbation theory approach to the ground state energy in an infinite Fermion system
[LA-UR-80-3658] N81-20848
Tests of dynamical supersymmetries via charged particle transfer reactions
[LA-UR-80-3476] N81-20849
ENERGY POLICY
The development of synthetic fuels: Department of Defense logistics implications
[AD-A095713] N81-20290
Coal preparation using magnetic separation. Volume 5: Evaluation of magnetic coal desulfurization concepts
[EPRI-CS-1517-VOL-5] N81-20302
Finned tube heat exchangers: State of the art for the air side
[CONF-800451-3] N81-20399
Development of high-temperature turbine subsystem technology to a technology readiness status, phase 2
[FE-1806-96] N81-20440
Highly efficient welding power supply
[DOE/CS-40023/T1] N81-20441
Satellite Power Systems (SPS) concept definition study (Exhibit D). Volume 6, part 1: Cost and Programmatics
[NASA-CR-3397] N81-20537
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG), volume 1
[NASA-CR-164051] N81-20538
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 2, appendix A: Selected DSG technologies and their general control requirements
[NASA-CR-164052] N81-20539
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 3, appendix B: State of the art, trends, and potential growth of selected DSG technologies
[NASA-CR-164054] N81-20540
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 4, appendix C: Identification from utility visits of present and future approaches to integration of DSG into distribution networks
[NASA-CR-164055] N81-20541
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 5, appendix D: Cost-benefit considerations for providing dispersed storage and generation for electric utilities
[NASA-CR-164053] N81-20542
Proceedings of the 16th Project Integration Meeting
[NASA-CR-164073] N81-20545
Heat exchange and solar energy, volume 2 --- conference proceedings, Rhode Saint Genese, Belguim
[VKI-LEC-SER-1980-2-VOL-2] N81-20549
Latent and chemical storage --- solar energy, thermochemical storage N81-20550
The benefits of advanced heat storage systems --- solar energy, phase changes, encapsulation, heat of fusion N81-20551
A method to tune the various components of a solar heating system --- economic factors and cost analysis N81-20552
Performance of air collector house heating systems with rock bed storage --- solar heating N81-20553
Water systems modeling --- solar collectors and heating systems N81-20554
System modeling using TRNSYS computer simulation --- solar heating N81-20555
Thermomechanical solar power/electricity generation. Technico-economic problems and prospectives of development and application N81-20556
The a priori decision in solar energy and conservation economics N81-20558
A life-cycle model for solar heating system design and economic evaluation Michigan Economic Model for Solar Heating (MESH) N81-20559
The 1980 flywheel technology symposium
[CONF-801022] N81-20561
Study of the potential for cogeneration in Canada: Industrial steam turbines. Volume 1: Main report
[NP-25187-VOL-1] N81-20563
Energy out of groundwater
[NE/HETV-80/9] N81-20565
Optimization of storage in passive solar heating systems
[DOE/CS-35405/T1] N81-20574
Marine biomass: Algae as source of energy
[NE/BIO-80/12] N81-20581
Solar collector foundation designs
[SAND-80-7070] N81-20582
Handbook for calculating solar-influenced building heat losses
[SAND-79-2173] N81-20583

Development of zinc-bromine batteries for utility energy storage
[DOE/ET-29345/21] N81-20591
Wind energy resource atlas. Volume 4: The Northeast region
[PNL-3195-WERA-4] N81-20592
Environmental assessment for the satellite power system concept development and evaluation program. Atmosphere effects
[DOE/ER-0090] N81-20598
Experimental study to define developments for terrestrial solar cell generators
[BMFT-FB-T-79-143] N81-20600
Fabrication of amorphous silicon solar cells, using an industrial process --- based on a nitride plasma reactor
[LEP-80.638.SME-689-A] N81-20602
Measurement of the transverse momenta of partons and of jet fragmentation as a function of square roots in p-p collisions: CCOR Collaboration
[DOE/ER-02232/92] N81-20853

ENERGY REQUIREMENTS
A reference building approach to building energy performance standards for single-family residences
[PB81-135642] N81-20318

ENERGY SOURCES
Groundwater as an alternative energy source for space heating and cooling, geothermal heat extraction
[DOE/TIC-11357] N81-20571

ENERGY SPECTRA
Elemental composition of solar energetic particles
[NASA-CR-164061] N81-21002

ENERGY STORAGE
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 2, appendix A: Selected DSG technologies and their general control requirements
[NASA-CR-164052] N81-20539
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 5, appendix D: Cost-benefit considerations for providing dispersed storage and generation for electric utilities
[NASA-CR-164053] N81-20542
Proceedings of the 16th Project Integration Meeting
[NASA-CR-164073] N81-20545
The 1980 flywheel technology symposium
[CONF-801022] N81-20561
Evaluation of solar collectors for heat pump applications
[DOE/CS-35351/T1] N81-20568
Evaluation of battery converters based on 4.8-MW fuel cell demonstrator inverter
[DOE/RA-26961/01] N81-20575
Development of zinc-bromine batteries for utility energy storage
[DOE/ET-29345/21] N81-20591

ENERGY TECHNOLOGY
LSA field test
[NASA-CR-164083] N81-20544
Engineering study of pelleting waste paper for energy recovery
[NZERDC-53] N81-20562
Coordination and management tasks for the IEA solar heating and cooling program and CCMS solar energy pilot study
[DOE/CS-30108/T3] N81-20567
Photovoltaics information user study
[SERI/TR-751-652] N81-20570
High concentration silicon photovoltaic cell development
[SAND-80-7068] N81-20595
Environmental assessment for the satellite power system concept development and evaluation program. Atmosphere effects
[DOE/ER-0090] N81-20598
The 10-kilowatt photovoltaic concentrator array fabrication
[SAND-80-7062] N81-20599
Flat plate thermal solar collectors: A physical background
[PB81-135741] N81-20605

ENERGY TRANSFER
Metal-metastable energy transfer for atomic luminescence N81-20203
Study of chemical reactions and energy transfer for high-energy and high-power lasers
[AD-A095706] N81-20414
Anomalous visible emission observed from the rear side of laser irradiated thin transparent targets
[AD-A095563] N81-20417
Solar wind energy and electric field transfer to the Earth's magnetosphere via magnetopause reconnection
[INPE-1940-RPE/259] N81-21001

ENGINE DESIGN
Simplified power supplies for ion thrusters
[NASA-TM-81725] N81-20177
Analytical design of an advanced radial turbine --- automobile engines
[NASA-CR-165170] N81-20958

ENGINE INLETS
Electromagnetic scattering by open circular waveguides --- modeling jet engine inlets
[AD-A095554] N81-20345

ENGINE MONITORING INSTRUMENTS
Individual jet engine stress load monitoring with the aid of the flight data recording system LEADS 200 N81-20013
Identification of jet engine damages by engine trend analysis LEADS 200 data N81-20014
Some effects of compressor fouling on the behavior of a turbojet engine --- as evidenced by an engine monitoring system N81-20015

ENGINE PARTS
Concept definition: Retirement for cause of F-100 rotor components
[AD-A095584] N81-20080
Ceramic components for gas turbines --- product design and manufacturing specification
[BMFT-FB-T-79-153] N81-20281

ENGINE STARTERS
Reasons for low aerodynamic performance of 13.5-centimeter-tip-diameter aircraft engine starter turbine
[NASA-TP-1810] N81-20076

ENGINE TESTS
Retrofit and verification test of a 30-cm ion thruster
[NASA-CR-165233] N81-20174

ENGINES
Considerations in the design of solar engines N81-20536

ENVIRONMENT EFFECTS
Environmetrics of synfuels. 1: Processing the automated PDP-11 data components for the UMD gasifier facility
[ORNL/TM-7428] N81-20305
Environmental assessment for the satellite power system concept development and evaluation program. Atmosphere effects
[DOE/ER-0090] N81-20598
The 1979 Southeastern Virginia Urban Plume Study. Volume 2: Data listings for NASA Cessna aircraft
[NASA-TM-81860-2] N81-20608
Consultation for the H2S and meteorological monitoring program of the Ente Nazional per l'Energia Elecrtrica (ENEL)
[DOE/ET-28502/1] N81-20680

ENVIRONMENT SIMULATORS
Design, construction and testing of a dc bioeffects test enclosure for small animals --- simulating the environment of high voltage dc transmission lines
[DOE/RA-10157/1] N81-20702

ENVIRONMENTAL MONITORING
Formulation and evaluation of new adhesives for highway use
[PB81-129835] N81-20286
Summary of the western energy overhead monitoring project
[PB81-129009] N81-20531
Mobile digital data acquisition and recording system for geoenergy process monitoring and control
[SAND-80-2123] N81-20584
Laser spectroscopy for the environment
[BMFT-FB-T-80-014] N81-20617
Propagation of traffic noise
[PB81-123523] N81-20619
International seismological data center: Procedures to check events through dynamic information and to estimate magnitudes --- monitoring for the nuclear test ban treaty
[FOA-C-20368-T1] N81-20648

ENVIRONMENTAL QUALITY
Global future: Time to act. Report to the President on global resources, environment and population N81-20957

ENZYMES
The enzyme spectrum of the small intestine with hypodynamia under conditions of high temperature
[NASA-TM-76150] N81-20727

ENZYMOLOGY
Activity of certain enzymes in subcellular fractions of rat liver after flight on Cosmos 1129 biosatellite
[NASA-TM-76472] N81-20701

EPITAXY
A feasibility study on the growth of bulk GaN single crystals
[AD-A095567] N81-20931
The application of nuclear techniques to solid state devices
[AD-A095251] N81-20933

EPOXY COMPOUNDS
Formulation and evaluation of new adhesives for highway use
[PB81-129835] N81-20286

EPOXY RESINS
Toughening of epoxy resin by acrylic elastomer N81-20273
Evaluation of the wedge cleavage test for assessment of durability of adhesive bonded joints --- epoxy resin
[RAE-TM-MAT-349] N81-20479

EQUATIONS
Computation of unsteady turbulent boundary layers with flow reversal and evaluation of two separate turbulence models
[NASA-TM-81259] N81-20384
On bounds for the specification of finite data types by means of equations and conditional equations --- algebraic data types
[MC-IW-131/80] N81-20781

EQUATIONS OF MOTION
Basic notions in rational mechanics and applications to space mechanics N81-20109
Studies in nonlinear motion
[AD-A095559] N81-20777
Improved acoustic approximations for submerged shells --- spherical shells N81-20829

EQUATORIAL ATMOSPHERE
Ionization and emission processes in the auroral and equatorial ionosphere --- support services for operation and data analysis
[AD-A095296] N81-20647

EQUILIBRIUM
One-dimensional space-charge neutralization of the ion beams
[SAND-80-2545] N81-20844

EQUILIBRIUM FLOW
A study of topographically-forced surface winds in Antarctica with special emphasis on the katabatic flow at Adelie Land N81-20655

EQUIPMENT SPECIFICATIONS
Apparatus for reconstruction --- of photogrammetric data; operational specifications N81-20505
Solar collector foundation designs
[SAND-80-7070] N81-20582

ERROR ANALYSIS
Tolerence and perturbation analysis N81-20334
Impact of system errors on TMR processing
[AD-A095382] N81-20348
Tropospheric refractivity profiles inferred from RF measurements Passive Refractive Index by Satellite Monitoring (PRISM)
[AD-A095498] N81-20643

ERROR CORRECTING DEVICES
Geometrical correction of images: Methods and performance N81-20517

ESTIMATES
A Monte Carlo comparison of robust and resistant estimators of bivariate correlation N81-20785

ESTIMATING
Aspects of efficiency robust estimation of location N81-20787
Simple estimation procedures based on rank tests for the one- and two-sample location models N81-20791
Further development of new methods for estimating tail probabilities and extreme value distributions
[AD-A095721] N81-20794

ETA-MESONS
Weak decays and charm searches
[COO-4831-3] N81-20846

ETCHING
Tantalum aluminum thin film technology for a new generation of microwave integrated circuit applications --- selective etching process control
[BMFT-FB-T-80-015] N81-20372
ETHANE
Permeation of protective garment material by liquid halogenated ethanes and a polychlorinated biphenyl
[LA-8572-MS] N81-20732
ETHERS
Infrared intensities of alcohols and ethers N81-20197
ETHYLENE COMPOUNDS
High voltage research (breakdown strengths of gaseous and liquid insulators) and environmental effects of dielectric gases --- halogenated ethylene compounds
[ORNL/TM-7624] N81-20366
EUROPEAN AIRBUS
The A310 Aircraft Integrated Data System (AIDS) N81-20017
EUROPEAN SPACE AGENCY
Management advantages of the standard work breakdown structure proposed by the European Space Agency for space satellite projects N81-20948
EUROPEAN SPACE PROGRAMS
With the solaris project CNES proposes to the Europeans the construction of an entirely automatic space laboratory
[NASA-TM-76492] N81-20144
EUTROPHICATION
A trophic classification of Minnesota lakes based on lake sediments
[PB81-124141] N81-20535
EVALUATION
Evaluation of the visual acquisition range of en-route air traffic from cockpit observations
[DFVLR-MITT-80-14] N81-20058
Evaluation of nondestructive inspection methods applied to milled step-down areas. Volume 1: Text and tables --- in aluminum alloys
[NLR-TR-78110-U-VOL-1] N81-20450
Evaluation of nondestructive inspection methods applied to milled step-down areas. Volume 2: Figures --- in aluminum alloys
[NLR-TR-78110-U-VOL-2] N81-20451
A life-cycle model for solar heating system design and economic evaluation Michigan Economic Model for Solar Heating (MESH) N81-20559
Description, evaluation, and sensitivity analyses analyses of principal US EPA air quality prediction models
[ANL/EES-TM-111] N81-20611
ADA test and evaluation
[AD-A095699] N81-20747
EVAPOTRANSPIRATION
Determination of regional evapotranspiration using energy balance, planetary boundary layer transfer coefficients and regularly recorded data N81-20626
EXAMINATION
Development of a new noninvasive method to determine the integrity of bone in vivo
[NASA-CR-160922] N81-20722
EXCIMER LASERS
Studies of free radicals by ultraviolet excimer laser photolysis
[DOE/ER-10396/2] N81-20419
EXCITATION
A response spectrum method for random vibrations
[PB81-122301] N81-20483
Laboratory tank studies of a single species of phytoplankton using a remote sensing fluorosensor
[NASA-TP-1821] N81-20492
EXCITONS
Electronic properties associated with donor impurities in multivalley semiconductors --- silicon, germanium and gallium phosphites N81-20917
EXHAUST EMISSION
Carbon dioxide and climate: A bibliography
[DOE/TIC-3382] N81-20677
EXHAUST GASES
Description, evaluation, and sensitivity analyses analyses of principal US EPA air quality prediction models
[ANL/EES-TM-111] N81-20611
Comparison of gas phase hydrocarbon emissions from light-duty gasoline vehicles and light-duty vehicles equipped with diesel engines
[PB81-122996] N81-20620
EXHAUSTION
Functional-morphological parallels of the hypothalamo-pituitary-adrenal system response reaction to long-term hypokinesia
[NASA-TM-76001] N81-20716
EXISTENCE THEOREMS
A proof of the existence of unstable periodic orbits using computer-based techniques N81-20770
EXOBIOLOGY
Islet in weightlessness: Biological experiments on board COSMOS 1129 satellite
[NASA-TM-76396] N81-20692
Life sciences: No place in the Sun --- NASA management N81-20978
EXPERIMENTAL DESIGN
Study on fluid phenomena influencing the design of zero-gravity experiments, volume 1
[TS-1-80-VOL-1] N81-20105
Study on fluid phenomena influencing the design of zero-gravity experiments. Volume 2: Users' guide
[TS-11-79-VOL-2] N81-20106
Contributions to survey sampling and design of experiments N81-20790
EXPLORER SATELLITES
Deepening perspective: A new look at the old world --- satellites and the earth sciences N81-20973
EXPLOSIVES
Explosibility of energetic material dusts
[AD-A095353] N81-20288
Safety and characterization tests on HIVELITE composition 300435
[AD-A095352] N81-20291
Numerical calculation of shock-induced initiation of detonations
[LA-UR-80-2854] N81-20303
Fast detonator-activated ball shutter for high explosive experiments
[UCID-18814] N81-20409
A study of gas solid reactions and air pollution detectors
[AD-A095253] N81-20610
EXPOSURE
Test and evaluation of foam-in-place fuel tank container
[AD-A095747] N81-20073
Plastic film performance improvement for heliostats
[SAND-79-8185] N81-20579
EXTERNAL STORES
Unsteady airloads on a harmonically pitching wing with external store
[NLR-MP-80004-U] N81-20038
EXTRAPOLATION
Extrapolation of orbits N81-20114
EXTREME ULTRAVIOLET RADIATION
A study of impurity transport with an EUV spatial imaging detector system on the Alcator A Tokamak N81-20878
EXTREMELY LOW FREQUENCIES
ULF/lower-ELF electromagnetic field measurements in the polar caps
[AD-A095283] N81-20343
EXTREMUM VALUES
Statistics for peak values of multiple coherence
[AD-A095460] N81-20795

F

F-18 AIRCRAFT
The F/A-18 Naval Strike Fighter: Progress has been made but problems and concerns continue
[AD-A095287] N81-20069
FABRICATION
Low cost, sprayed CdTe solar cell research
[SERI/PR-8104-3-T2] N81-20585
Investigation of solar cells based on Cu20
[DOE/ET-23006/4] N81-20593
The 10-kilowatt photovoltaic concentrator array fabrication
[SAND-80-7062] N81-20599
FACE CENTERED CUBIC LATTICES
Temperature dependences of hyperfine fields at SP-impurities in fcc-cobalt studied by nuclear spin precession following heavy-ion reactions N81-20926
FACTOR ANALYSIS
Modified factor analysis of selected RAPS (Regional Air Pollution Study) aerosol data --- St. Louis, Missouri area
[PB81-120784] N81-20622
Infinite frequency interpretations of minimal bases --- factorizations of rational matrices
[MATH-RES-148] N81-20783
FAILURE ANALYSIS
Some effects of compressor fouling on the behavior of a turbojet engine --- as evidenced by an engine monitoring system N81-20015
Some effects of thermal-cycle-induced deformation in rocket thrust chambers
[NASA-TP-1834] N81-20176
Ultrasonic Materials Characterization
[PB81-124984] N81-20412
Non-destructive failure prediction for brittle solids
[LBL-10341-REV] N81-20448
Bayesian optimal designs for surveillance procedures in attribute life testing
[AD-A095723] N81-20796
FAILURE MODES
Deformation characteristics and failure modes of notched graphite polymide composites at room and elevated temperatures --- nondestructive test techniques
[NASA-CR-159375] N81-20185
Acoustic emission monitoring of polymer composite materials
[NASA-TM-76523] N81-20187
Life prediction methods for the combined creep-fatigue endurance
[ND-R-471(R)] N81-20471
FAR INFRARED RADIATION
Infrared spectra of some sulfides and their analogs of binary composition in the long-wave region
[NASA-TM-75901] N81-20217
The design study of a far infrared heterodyne spectrometer assembly, volume 1 --- spaceborne applications
[ESS/CCG-118-VOL-1] N81-20989
The design study of a far infrared heterodyne spectrometer assembly, volume 2 --- power conditioner
[ESS/CCG-118-VOL-2] N81-20990
FAR ULTRAVIOLET RADIATION
Far-ultraviolet spectral and spatial imaging of Jupiter and Saturn N81-20987
FASTENERS
An experimental study of large compressive loads upon residual strain fields and the interaction between surface strain fields created by coldworking fastener holes N81-20454
Critically loaded hole technology pilot collaborative test programme
[AGARD-R-678] N81-20461
FATIGUE (MATERIALS)
Deformation microstructure developed during fatigue crack propagation in type 316 stainless steel at 593 deg C
[AD-A095387] N81-20246
Critically loaded hole technology pilot collaborative test programme
[AGARD-R-678] N81-20461
FATIGUE LIFE
Statistical review of counting accelerometer data for Navy and Marine fleet aircraft
[AD-A095617] N81-20070
Concept definition: Retirement for cause of F-100 rotor components
[AD-A095584] N81-20080
Determination of load sequence effects on the degradation and failure of composite materials --- Graphite-epoxy composites
[NASA-CR-164065] N81-20186
Examination of the strength of high temperature alloys for gas turbines in hot gas environments
[BMFT-FB-T-79-150] N81-20267
Turbine materials characteristics under low cycle fatigue --- turbine engine disk life
[BMFT-FB-T-79-151] N81-20268
Life analysis of multiroller planetary traction drive
[NASA-TP-1710] N81-20423
Life prediction methods for the combined creep-fatigue endurance
[ND-R-471(R)] N81-20471
FATIGUE TESTS
Ultrasonic Materials Characterization
[PB81-124984] N81-20412

Plastic film performance improvement for heliostats
[SAND-79-8185] N81-20579

FAULT TOLERANCE
Autonomous spacecraft maintenance study group
[NASA-CR-164076] N81-20168
Tolerence and perturbation analysis N81-20334

FAULT TREES
Integrating reliability analysis and design
[ALO-131] N81-20449

FEASIBILITY ANALYSIS
Possible online uses of AIDS data in future ATC systems N81-20018
A feasibility study of an instrument for measuring wind speed employing vortex shedding
[BU-254] N81-20411
Satellite limitations compared to mission requirements for Earth observation N81-20512
A feasibility study on the growth of bulk GaN single crystals
[AD-A095553] N81-20932

FEDERAL BUDGETS
NASA gets under way N81-20970
Objectives, plans, and budgets --- nasa programs N81-20983

FERMIONS
Perturbation theory approach to the ground state energy in an infinite Fermion system
[LA-UR-80-3658] N81-20848
Tests of dynamical supersymmetries via charged particle transfer reactions
[LA-UR-80-3476] N81-20849

FERROELECTRICITY
The role of positional disorder in ferroelectric relaxors N81-20923

FIBER OPTICS
Ultra low loss optical fiber cable assemblies
[AD-A095551] N81-20870
Exploratory development model hermaphroditic fiber optic connectors
[AD-A095276] N81-20871
Development of components for optical communications with light guiding fibers
[BMFT-FB-T-80-006] N81-20874

FIBER ORIENTATION
Scarf joints in unidirectional carbon fiber reinforced plastics --- tests of repairs made using adhesives
[BU-258] N81-20193

FIBER REINFORCED COMPOSITES
Experimental studies of the delamination mechanisms in impacted fiber-reinforced composite plates N81-20183
Flexure tests of three fibrous composite materials
[FFA-TN-HU-2127-PT-3] N81-20192

FIBERS
Carbon/graphite composite material study
[NASA-CR-164084] N81-20189

FIBRIN
The role of ACTH and glucocorticoids in nonenzymatic fibrinolysis during immobilization stress in animals
[NASA-TM-76175] N81-20693

FIELD THEORY (PHYSICS)
Study on fluid phenomena influencing the design of zero-gravity experiments, volume 1
[TS-1-80-VOL-1] N81-20105

FILTER WHEEL INFRARED SPECTROMETERS
The design study of a far infrared heterodyne spectrometer assembly, volume 1 --- spaceborne applications
[ESS/CCG-118-VOL-1] N81-20989
The design study of a far infrared heterodyne spectrometer assembly, volume 2 --- power conditioner
[ESS/CCG-118-VOL-2] N81-20990

FILTRATION
Technical and economic feasibility of membrane technology
[DOE/CS-40213/T1] N81-20231
Melt purification via filtration
[AD-A095414] N81-20253

FINITE DIFFERENCE THEORY
Finite-difference method for the arbitrary cross-section waveguide problem using the best-fit boundary approximation
[INPE-1956-RPE/270] N81-20049
Numerical calculation of shock-induced initiation of detonations
[LA-UR-80-2854] N81-20303
Alternating-direction implicit numerical solution of the time dependent, three-dimensional, Singlt fluid, resistive magnetohydrodynamic equations
[UCRL-53086] N81-20780

FINITE ELEMENT METHOD
MARIAH: A finite element computer program for incompressible porous flow problems
[SAND-79-1623] N81-20402
Hydrodynamic pressure and added mass for axisymmetric bodies --- finite element method
[PB81-122343] N81-20404
The 3D solid element (type 4 - elastic or elastic-perfectly-plastic) for the ANSR-11 program --- nonlinear structural response
[PB81-123242] N81-20485
Finite element simulations of stratified flow over simple geometrical obstructions and arbitrarily complex terrain N81-20607
The minimax finite-element method N81-20771
Finite elements for initial value problems in dynamics
[AD-A095344] N81-20776

FIRE FIGHTING
Gas chromatography of polybrominated biphenyls utilizing electron capture detection N81-20199

FIRE PREVENTION
Study of materials performance model for aircraft interiors
[NASA-CR-152378] N81-20063

FISSION PRODUCTS
Recovery and use of fission product noble metals
[PNL-SA-8358] N81-20258

FIXED POINTS (MATHEMATICS)
The geometry of geodesy --- to determine unknowns in position N81-20497

FLAME SPECTROSCOPY
Measurement of the line reversal temperature of OH in CH4/N2 O flames
[AD-A095349] N81-20408

FLAME TEMPERATURE
Measurement of the line reversal temperature of OH in CH4/N2 O flames
[AD-A095349] N81-20408

FLAMES
A study of flame spreading and combustion processes in solid propellant cracks N81-20214

FLAT PLATES
Flat plate thermal solar collectors: A physical background
[PB81-135741] N81-20605

FLEXIBILITY
Modifications to the Flexible Spacecraft Dynamics Program
[NASA-CR-166855] N81-20166

FLEXIBLE SPACECRAFT
The reduced order model problem in distributed parameter systems adaptive identification and control --- adaptive control of flexible spacecraft
[NASA-CR-164059] N81-20761

FLEXING
Flexure tests of three fibrous composite materials
[FFA-TN-HU-2127-PT-3] N81-20192

FLIGHT CONTROL
A short note on AIDS and windshear: British airways experience --- with a modified vertical speed indicator N81-20012
An analytical study of the longitudinal response of airplanes to positive wind shear
[NASA-TP-1765] N81-20082

FLIGHT CREWS
Nuclear survivability/vulnerability of aircrews: An experimental approach
[AD-A095501] N81-20729

FLIGHT HAZARDS
Airborne lightning warning systems: A survey
[AD-A095354] N81-20045
An analytical study of the longitudinal response of airplanes to positive wind shear
[NASA-TP-1765] N81-20082

FLIGHT INSTRUMENTS
Testing aircraft instruments
[AD-A095680] N81-20075

FLIGHT LOAD RECORDERS
Statistical review of counting accelerometer data for Navy and Marine fleet aircraft
[AD-A095617] N81-20070

FLIGHT OPTIMIZATION
Generation of optimum vertical profiles for an advanced flight management system
[NASA-CR-165674] N81-20051

FLIGHT PATHS
Design of a fuel-efficient guidance system for a STOL aircraft
[NASA-TM-81256] N81-20006
Generation of optimum vertical profiles for an advanced flight management system
[NASA-CR-165674] N81-20051
Evaluation of the visual acquisition range of en-route air traffic from cockpit observations
[DFVLR-MITT-80-14] N81-20058

FLIGHT PLANS
Space Shuttle Program. Mission operation report. Orbital Flight Test reference document
[NASA-TM-82321] N81-20164

FLIGHT RECORDERS
On contributions to the 10th Symposium on Aircraft Integrated Data Systems (AIDS) --- Aachen, 26-27 Mar. 1980
[DFVLR-MITT-80-09] N81-20007
flight data recording and data processing for light airplanes and gliders N81-20008
Digital filtering of PCM-recorded flight data for wind-processing N81-20009
Experiences with flight recorders obtained by analyzing aircraft accidents N81-20019
A technique for recovering nonsynchronized data from a digital flight data recorder N81-20020
A quick-look system for the processing of flight data recordings N81-20021

FLIGHT SAFETY
Initial design and experimental implementation of the traffic advisory service of ATARS
[AD-A095462] N81-20055

FLIGHT SIMULATION
A simple hybrid visual simulation for research flight simulators
[DFVLR-MITT-80-13] N81-20088
Fidelity of simulation for pilot training
[AGARD-AR-159] N81-20091
Physiological factors N81-20094
Simulation technology N81-20095
Pilot assessment of Training simulators N81-20098

FLIGHT SIMULATORS
A simple hybrid visual simulation for research flight simulators
[DFVLR-MITT-80-13] N81-20088

FLIGHT TEST INSTRUMENTS
A short note on AIDS and windshear: British airways experience --- with a modified vertical speed indicator N81-20012

FLIGHT TESTS
Flight tests of the microwave landing system multimode digital processor
[AD-A095449] N81-20056
Investigation of Flight Test Methods for measuring the performance of general aviation aircraft
[NASA-CR-164057] N81-20065
Recent progress in V/STOL aircraft technology
[NASA-TM-81281] N81-20066
Diagnostic system design for the Ion Auxiliary Propulsion System (IAPS). Flight tests of two 8 cm mercury ion
[NASA-TM-81702] N81-20172

FLIR DETECTORS
Target tracking and target detection in TV- and FLIR-imagery N81-20820
Autonomous target screeners N81-20822

FLOOD CONTROL
Water resource priorities for the midwest --- Ohio, Indiana, Illinois, Michigan, Minnesota, Wisconsin, and Iowa
[PB81-129801] N81-20315

FLOW
Computation of unsteady turbulent boundary layers with flow reversal and evaluation of two separate turbulence models
[NASA-TM-81259] N81-20384

FLOW CHARACTERISTICS
Dual nozzle aerodynamic and cooling analysis study
[NASA-CR-161677] N81-20175
Nonequilibrium effects in wet-steam turbines N81-20430
High-frequency sound propagation in a spatially varying mean flow
[NASA-TM-81751] N81-20831

FLOW DIRECTION INDICATORS
Experimental investigations on the V/STOL tunnel at NASA/Langley Research Center
[NASA-CR-165655] N81-20028
FLOW DISTRIBUTION
A quantitative Schlieren system for measuring radial density profiles of reduced density channels in gases
[AD-A095295] N81-20407
FLOW GEOMETRY
An application of the embedded grid technique to the calculation of transonic flow past wings --- Cartesian grids and programming
[FFA-TN-AU-1600] N81-20036
FLOW MEASUREMENT
Experimental investigations on the V/STOL tunnel at NASA/Langley Research Center
[NASA-CR-165655] N81-20028
Measurements and predictions of complex turbulent flows, volume 2 --- conference, Belgium, 11-15 Feb. 1980
[VKI-LS-1980-3-VOL-2] N81-20385
Information content of LDA-signals and operations of LDA-signal processors --- measurement of flow properties N81-20387
High speed velocity measurements using laser-Doppler anemometers --- application to turbulent fluid flows and measurement optimization N81-20388
Turbulent mixing and concentration measurement --- in nozzle flows N81-20390
FLOW THEORY
National Transonic Facility: A review of the operational plan
[PB81-115289] N81-20090
FLOW VISUALIZATION
Phase control during reconstruction of holographically recorded flow fields using real-time holographic interferometry
[NASA-TM-81953] N81-20405
FLUID DYNAMICS
An asymptotic method for determining the transport of heat and matter by creeping flows with strongly variable viscosity; Fluid-dynamic problems motivated by island arc volcanism N81-20633
FLUID FLOW
Atmospheric Studies in Complex Terrain (ASCOT) information survey
[UCID-18572] N81-20615
Oscillating grid turbulence, including the effects of rotation N81-20881
FLUID MECHANICS
Study on fluid phenomena influencing the design of zero-gravity experiments, volume 1
[TS-1-80-VOL-1] N81-20105
Study on fluid phenomena influencing the design of zero-gravity experiments. Volume 2: Users' guide
[TS-11-79-VOL-2] N81-20106
FLUORESCENCE
Laser fluorescence immunoassay N81-20206
Laser fluorescence detection for high performance liquid chromatography N81-20207
Laboratory tank studies of a single species of phytoplankton using a remote sensing fluorosensor
[NASA TP-1821] N81-20492
FLUX (RATE)
Atmospheric effects on low-power laser beam propagation
[AD-A095383] N81-20418
Evidence for magnetic field reconnection at the Earth's magnetopause
[NASA-CR-164066] N81-20637
FLUX DENSITY
Theory of flux-flow voltage noise in type-2 superconductors N81-20920
FLUX PINNING
Fluxoid pinning by planar defects in Pb-Bi alloy films N81-20927
FLYWHEELS
The 1980 flywheel technology symposium
[CONF-801022] N81-20561
FOAMS
Test and evaluation of foam-in-place fuel tank container
[AD-A095747] N81-20073
Development and validation of cryogenic foam insulation for LH2 subsonic transports
[NASA-CR-3404] N81-20312
FOCUSING
Results on the performance of a broad hand focusing Cherenkov counter
[COO-3072-119] N81-20410
FOG
Fog characteristics at Otis AFB, Massachusetts
[AD-A095358] N81-20676
FOILS (MATERIALS)
Anomalous visible emission observed from the rear side of laser irradiated thin transparent targets
[AD-A095563] N81-20417
FOKKER-PLANCK EQUATION
Orbit averaged radial buildup code for tandem mirror geometry
[UCID-18905] N81-20907
FOOD CHAIN
Gas chromatography of polybrominated biphenyls utilizing electron capture detection N81-20199
FORCE DISTRIBUTION
The prediction of normal force and rolling moment coefficients for a spinning wing
[NASA-CR-165680] N81-20068
National Transonic Facility: A review of the operational plan
[PB81-115289] N81-20090
FORCE-FREE MAGNETIC FIELDS
Ideal MHD equilibrium of a weakly toroidal plasma column with elongated cross section. Part 2: Force-free fields
[REPT-80-124-PT-2] N81-20911
FORECASTING
Green River Basin flow forecasting models
[PB81-124448] N81-20529
FOREST MANAGEMENT
A watershed information system
[PB81-127433] N81-20528
FORESTS
Carbon dioxide and climate: A bibliography
[DOE/TIC-3382] N81-20677
FORGING
Forging of powder metallurgy gears
[AD-A095556] N81-20247
Engineering property comparisons for four AlZnMgCu type forging alloys
[NLR-TR-79022-U] N81-20270
FORMALISM
A formal methodology using attributed grammar for multiprocessing system design N81-20736
A Newman-Penrose type formalism for space-times with torsion. Part 2: Exact plane wave solutions
[MATH-RES-143-PT-2] N81-20944
Ghost neutrinos in Einstein-Cartan theory --- a Newman-Penrose type formalism
[MATH-RES-146] N81-20945
A Newman-Penrose type formalism for space-times with torsion. Part 3: Neutrino fields in Einstein-Cartan theory
[MATH-RES-147-PT-3] N81-20946
FORMING TECHNIQUES
Metallurgical characterization of superplastic forming
[AD-A095720] N81-20255
Upper-bound solutions to flow through conical converging dies --- metal forming
[DOE/ER-10367/T3] N81-20400
Graphite composite truss welding and cap section forming subsystems. Volume 1: Executive summary --- large space structures
[NASA-CR-160933] N81-20462
FORTRAN
Description of a digital computer simulation of an Annular Momentum Control Device (AMCD) laboratory test model
[NASA-TM-81797] N81-20741
A FORTRAN computer program for calculating the propagation of plane, cylindrical or spherical finite amplitude waves
[AD-A095386] N81-20832
Advanced Query Facility
[AD-A095717] N81-20950
Modular file-structured databasing system
[SAND-80-2336C] N81-20953
FOSSIL FUELS
Coal conversion 1979 technical report
[DOE/FE-0010] N81-20297
Coal hydrogasification process development
[DOE/ET-10328/27] N81-20304
Considerations in the design of solar engines N81-20536
FOULING
Some effects of compressor fouling on the behavior of a turbojet engine --- as evidenced by an engine monitoring system N81-20015
FOUNDATIONS
Buckling of a rectangular plate on an elastic foundation, compressed in two directions N81-20457
Solar collector foundation designs
[SAND-80-7070] N81-20582
FOURIER TRANSFORMATION
Fourier transform infrared spectroscopic studies on the thermal degradation of polyacrylonitrile copolymers
[AD-A095270] N81-20277
Hardware implementations of Fourier Transform signal processing
[PB81-123200] N81-20351
Performance of the discrete Fourier Transform satellite imagery classification technique
[AD-A095364] N81-20670
FRACTURE MECHANICS
Deformation characteristics and failure modes of notched graphite polymide composites at room and elevated temperatures --- nondestructive test techniques
[NASA-CR-159375] N81-20185
Engineering properties of the recently developed aluminum alloy designated 7010 --- thick plates
[NLR-TR-79017-U] N81-20269
Mechanisms of elevated temperature rupture in single phase ceramics
[DOE/ER-10591/1] N81-20280
Non-destructive failure prediction for brittle solids
[LBL-10341-REV] N81-20448
Crack propagation in electron beam welded Ti-6Al-4 under spectrum loading conditions
[AD-A095585] N81-20467
The delayed fracture of aluminum alloys --- stress corrosion cracking
[AD-A095732] N81-20468
Fracture mechanics and dynamic response of structures
[AD-A095272] N81-20469
FRACTURES (MATERIALS)
Dynamic piping fracture coupled with system effects
[EPRI-NP-1640] N81-20470
FRANCE
Orthostatic hypotension
[NASA-TM-75889] N81-20728
FREE ELECTRON LASERS
LASL Free Electron Laser experiment
[LA-UR-80-3187] N81-20420
FREE RADICALS
Free radical propulsion concept
[NASA-TM-81770] N81-20180
Studies of free radicals by ultraviolet excimer laser photolysis
[DOE/ER-10396/2] N81-20419
FRENCH SATELLITES
Positioning SPOT images: Reconstitution from a stereoscopic pair --- and photogrammetric implications N81-20510
Overview of the SPOT mission and description of the ground segment N81-20519
The SPOT satellite image processing facility in Toulouse and its capabilities N81-20520
FRENCH SPACE PROGRAMS
The SPOT satellite image processing facility in Toulouse and its capabilities N81-20520
FREON
Study of heat rejection systems --- space shuttle radiator using freon
[TC-80-TR-0054] N81-20165
FREQUENCY ASSIGNMENT
Preliminary interface revision notice SD-152C update of section 8.3 of ICD 2-19001 for detached payloads N81-20163
FREQUENCY STABILITY
Stability of VLF group velocity over long ranges N81-20321
FRESNEL LENSES
Solar coal gasification
[DOE/TIC-11384] N81-20587
FRICTION MEASUREMENT
Magnetic bearing reaction wheel tests --- satellite applications
[CNES-80/CT/PRT/SST/SS/162] N81-20444

FUEL CAPSULES
Engineering study of pelleting waste paper for energy recovery
[NZERDC-53] N81-20562
FUEL CELLS
Evaluation of battery converters based on 4.8-MW fuel cell demonstrator inverter
[DOE/RA-26961/01] N81-20575
FUEL COMBUSTION
Combustion of drops and sprays of heavy fuel oils and their emulsions
[AD-A095612] N81-20220
FUEL CONSUMPTION
Generation of optimum vertical profiles for an advanced flight management system
[NASA-CR-165674] N81-20051
A look at NASA's Aircraft Energy Efficiency program
[PSAD-80-50] N81-20077
The development of synthetic fuels: Department of Defense logistics implications
[AD-A095713] N81-20290
FUEL OILS
Combustion of drops and sprays of heavy fuel oils and their emulsions
[AD-A095612] N81-20220
FUEL TANKS
Test and evaluation of foam-in-place fuel tank container
[AD-A095747] N81-20073
Development and validation of cryogenic foam insulation for LH2 subsonic transports
[NASA-CR-3404] N81-20312
FUELS
Ignition of a liquid fuel under high intensity radiation
[AD-A095691] N81-20223
FULL SCALE TESTS
Motorcycle aerodynamics in performance --- wind tunnel and driving tests
[BU-253] N81-20042
The semi-operational evaluation of the trajectory prediction method for Signal Automatic Radar Processing (SARP) 2 --- air traffic control
[NLR-MP-79038-U] N81-20059
Field turbine tests --- of large steam turbine generator units N81-20431
FUNCTION SPACE
A general dynamic synthesis for complex structures composed of substructures N81-20455
FUNCTIONAL ANALYSIS
Total system design methodology
[AD-A095727] N81-20054
FUNCTIONAL DESIGN SPECIFICATIONS
Apparatus for reconstruction --- of photogrammetric data; operational specifications N81-20505
FUNCTIONS (MATHEMATICS)
Function space variable metric methods with applications to singular optimal control computation N81-20759
The complexity of provable properties of first order theories
[AD-A095656] N81-20773
Continuity of the optimal value function under the Mangasarian-Fromovitz Constraint Qualification
[AD-A095422] N81-20800
FUSELAGES
An investigation of drag associated with the upswept rear fuselage of a helicopter
[BU-257] N81-20043
FUSION REACTORS
Development of an irradiation creep correlation for 20% cold-worked AISI 316 in fusion environments: DAFS contribution
[DOE/FF-02170/T58] N81-20475
Mirror fusion test facility magnet system
[UCRL-52955] N81-20904

G

GALACTIC EVOLUTION
A study of the interstellar medium in NGC 185 and other early-type galaxies N81-20992
GALACTIC RADIO WAVES
MM-wave and X-ray observastions of a Cen-A flare
[INPE-1958-RPE/272] N81-21005
GALAXIES
A study of the interstellar medium in NGC 185 and other early-type galaxies N81-20992
GALERKIN METHOD
Finite element simulations of stratified flow over simple geometrical obstructions and arbitrarily complex terrain N81-20607
GALLIUM ALLOYS
Microstructure and properties of A15 superconductors formed by direct precipitation
[LBL-11605] N81-20367
GALLIUM ARSENIDE LASERS
Development of components for optical communications with light guiding fibers
[BMFT-FB-T-80-006] N81-20874
GALLIUM ARSENIDES
Analysis of costs of gallium arsenide and silicon solar arrays for space power applications
[NASA-TP-1811] N81-20173
Semiconductor devices for optical communications in 1 micron band of wavelength --- gallium indium arsenide phosphide lasers and diodes
[NASA-TM-75869] N81-20867
Growth, characterization, and applications of gallium arsenide and germanium layers grown by molecular beam epitaxy N81-20928
Materials for opto-electronic devices --- fabrication of doped GaAs and GaP materials
[BMFT-FB-T-80-026] N81-20940
GALLIUM COMPOUNDS
A feasibility study on the growth of bulk GaN single crystals
[AD-A095553] N81-20932
GALLIUM NITRIDES
A feasibility study on the growth of bulk GaN single crystals
[AD-A095567] N81-20931
GALLIUM PHOSPHIDES
Electronic properties associated with donor impurities in multivalley semiconductors --- silicon, germanium and gallium phosphites N81-20917
Materials for opto-electronic devices --- fabrication of doped GaAs and GaP materials
[BMFT-FB-T-80-026] N81-20940
GAMMA RAY ASTRONOMY
On the origin of the March 5, 1979 gamma ray transient: A vibrating neutron star in the Large Magellanic Cloud
[NASA-TM-80738] N81-21006
GAMMA RAYS
Nuclear survivability/vulnerability of aircrews: An experimental approach
[AD-A095501] N81-20729
Correlation of aligned angular momentum with scattering angle and energy loss in deeply inelastic collisions
[DOE/ER-01388/464] N81-20840
On the origin of the March 5, 1979 gamma ray transient: A vibrating neutron star in the Large Magellanic Cloud
[NASA-TM-80738] N81-21006
GARMENTS
Permeation of protective garment material by liquid halogenated ethanes and a polychlorinated biphenyl
[LA-8572-MS] N81-20732
GAS CHROMATOGRAPHY
Gas chromatography of polybrominated biphenyls utilizing electron capture detection N81-20199
Classification of petroleum samples from gas chromatographic data by pattern recognition techniques and simulation of mass spectra by regression analysis of structural descriptors N81-20202
Detection of metal ions by glass capillary gas chromatographic separation of their volatile chelates N81-20212
GAS DENSITY
Optical measurements of the diffusion of a heavy gas in turbulent boundary layer --- inside a wind tunnel N81-20391
Density measurement in air with a saturable absorbing seed gas
[NASA-CR-164063] N81-20641
GAS DISCHARGES
Investigation of the production of high density uniform plasmas
[AD-A095508] N81-20893
GAS FLOW
Density measurement in air with a saturable absorbing seed gas
[NASA-CR-164063] N81-20641
GAS LASERS
Ultraviolet phase conjugation and its practical implication
[LA-UR-80-3621] N81-20873
GAS TRANSPORT
Applied research and evaluation of process concepts for liquefaction and gasification of western coals
[DOE/ET-10527/T1] N81-20292
GAS TURBINE ENGINES
Ceramic components for gas turbines --- product design and manufacturing specification
[BMFT-FB-T-79-153] N81-20281
High-reliability gas turbine combined-cycle development program, phase 1. Volume 2: Appendixes
[EPRI-AP-1599-VOL-2] N81-20434
GAS TURBINES
Examination of the strength of high temperature alloys for gas turbines in hot gas environments
[BMFT-FB-T-79-150] N81-20267
Development of high-temperature turbine subsystem technology to a technology readiness status, phase 2
[FE-1806-96] N81-20440
GAS-METAL INTERACTIONS
A theoretical investigation of the pyrolysis of solid fuels including condensation effects N81-20213
Effects of hydrogen on the elastic constants of vanadium and palladium single crystals N81-20242
Plasma chemistry for inorganic materials
[NASA-TM-75844] N81-20889
GAS-SOLID INTERFACES
Corrosion control through a better understanding of the metallic substrate/organic coating/interface
[AD-A095420] N81-20252
Ultrasonic imaging with narrow beam insonification across a fluid-metal interface N81-20827
GASEOUS DIFFUSION
Optical measurements of the diffusion of a heavy gas in turbulent boundary layer --- inside a wind tunnel N81-20391
GASOLINE
Comparison of gas phase hydrocarbon emissions from light-duty gasoline vehicles and light-duty vehicles equipped with diesel engines
[PB81-122996] N81-20620
GASTROINTESTINAL SYSTEM
The enzyme spectrum of the small intestine with hypodynamia under conditions of high temperature
[NASA-TM-76150] N81-20727
GATES (CIRCUITS)
Controller for computer control of brushless dc motors --- automobile engines
[NASA-CASE-NPO-13970-1] N81-20352
GEARS
Forging of powder metallurgy gears
[AD-A095556] N81-20247
GENERAL AVIATION AIRCRAFT
Investigation of Flight Test Methods for measuring the performance of general aviation aircraft
[NASA-CR-164057] N81-20065
GEOCHEMISTRY
The petrology and geochemistry of the Baltimore Mafic Complex, Maryland N81-20627
GEOCHRONOLOGY
Geology and geochronology of the Halloran Hills, southeastern California, and implications concerning mesozoic tectonics of the southwestern Cordillera N81-20628
GEODESY
Spaceborne cartography of the Earth --- conference; Toulouse, 5-19 Jun. 1979 N81-20496
The geometry of geodesy --- to determine unknowns in position N81-20497
GEOIDS
Research of the state of convection in the Earth's mantle
[NASA-CR-163989] N81-20639
GEOLOGICAL FAULTS
Evidence for fault asperities from systematic time-domain modeling of teleseimic waveforms N81-20630
Geophysical investigations of the southern continental margin of Australia and the conjugate sector of East Antarctica N81-20632

GEOLOGICAL SURVEYS
Groundwater heat pumps: An examination of hydrogeologic, environmental, legal, and economic factors affecting their use. Volume 2: Appendix D, state hydrogeologic descriptions and maps
[DOE/CS-20060/5120-VOL-2] N81-20398
Comparative assessment of five potential sites for hydrothermal-magma systems: Summary
[DOE/TIC-11303] N81-20525
GEOMETRICAL OPTICS
Nonlinear optical phase conjugation by 3-wave and 4-wave mixing N81-20862
GEOMORPHOLOGY
Analogs of Martian eolian features in southwestern Egypt N81-20640
GEOPHYSICS
Geophysical investigations of the southern continental margin of Australia and the conjugate sector of East Antarctica N81-20632
GEOS 3 SATELLITE
Research of the state of convection in the Earth's mantle
[NASA-CR-163989] N81-20639
GEOSYNCHRONOUS ORBITS
Positioning a geostationary satellite N81-20127
Geostationary satellite stationkeeping. Orbit perturbation --- and correction N81-20128
Geostationary satellite stationkeeping: Orbit correction strategies N81-20129
GEOTHERMAL ENERGY EXTRACTION
Groundwater as an alternative energy source for space heating and cooling, geothermal heat extraction
[DOE/TIC-11357] N81-20571
Basic research needed for the development of geothermal energy
[LA-8562-MS] N81-20580
Mobile digital data acquisition and recording system for geoenergy process monitoring and control
[SAND-80-2123] N81-20584
Consultation for the H2S and meteorological monitoring program of the Ente Nazional per l'Energia Elecrtrica (ENEL)
[DOE/ET-28502/1] N81-20680
GEOTHERMAL RESOURCES
Comparative assessment of five potential sites for hydrothermal-magma systems: Summary
[DOE/TIC-11303] N81-20525
Basic research needed for the development of geothermal energy
[LA-8562-MS] N81-20580
GEOTHERMAL TECHNOLOGY
Basic research needed for the development of geothermal energy
[LA-8562-MS] N81-20580
GERMANIUM
Electronic properties associated with donor impurities in multivalley semiconductors --- silicon, germanium and gallium phosphites N81-20917
Growth, characterization, and applications of gallium arsenide and germanium layers grown by molecular beam epitaxy N81-20928
GERMANIUM COMPOUNDS
Electric conduction in n-type germanium and cadmium sulfide
[INPE-1950-RPE/266] N81-20358
GERMANY
The 1981 Budget of the German Federal Ministry for Research and Technology
[NASA-TM-76493] N81-20956
GEYSERS
Consultation for the H2S and meteorological monitoring program of the Ente Nazional per l'Energia Elecrtrica (ENEL)
[DOE/ET-28502/1] N81-20680
GLACIERS
Radar investigations of the Ross Ice Shelf N81-20631
GLASS
Radiation effects in crystalline high-level nuclear waste solids
[PNL-SA-8732] N81-20858
A search for the origin of low temperature anomalies in glasses N81-20922
GLIDERS
flight data recording and data processing for light airplanes and gliders N81-20008
GLOBAL POSITIONING SYSTEM
Total system design methodology
[AD-A095727] N81-20054
GLUONS
Quark and gluon decay functions in QCD and recombination model
[DOE/ER-70004/266] N81-20845
GOVERNMENT PROCUREMENT
Microelectronics availability for the Army's missiles
[AD-A095379] N81-20152
GOVERNMENT/INDUSTRY RELATIONS
Issues of commonality. Volume 2: Issue analysis
[AD-A095418] N81-20046
GRAIN BOUNDARIES
Ultrasonic Materials Characterization
[PB81-124984] N81-20412
Diffusional creep of multicomponent systems
[COO-2296-22] N81-20474
GRAMMARS
A formal methodology using attributed grammar for multiprocessing system design N81-20736
GRANULAR MATERIALS
The deformation of grains during cold-rolling N81-20238
GRAPHIC ARTS
Cartography --- generalities on the compilation of maps N81-20498
GRAPHITE
Friction and wear studies of graphite and a carbon-carbon composite in air and helium
[GA-A-16054] N81-20191
Casting procedure for barium metal cones used in high-altitude experiments --- reusable graphite molds
[LA-8517-MS] N81-20260
Graphite composite truss welding and cap section forming subsystems. Volume 2: Program results
[NASA-CR-160932] N81-20463
Experimental and theoretical studies of donor-type graphite intercalated compounds
[AD-A095282] N81-20935
GRAPHITE-EPOXY COMPOSITE MATERIALS
Determination of load sequence effects on the degradation and failure of composite materials --- Graphite-epoxy composites
[NASA-CR-164065] N81-20186
Damage tolerance of hybrid structures --- crack propagation in aluminum alloy sheet reinforced by four unidirectional fiber/epoxy strips
[BMVG-FBWT-79-27] N81-20477
GRAPHITE-POLYIMIDE COMPOSITES
Deformation characteristics and failure modes of notched graphite polymide composites at room and elevated temperatures --- nondestructive test techniques
[NASA-CR-159375] N81-20185
GRAPHS (CHARTS)
Some problems in combinatorial matrix theory N81-20798
GRATINGS (SPECTRA)
Grating lobes N81-20333
GRAVITATION THEORY
Accuracy of gravitational physics tests using ranges to the inner planets
[NASA-CR-164080] N81-20998
GRAVITATIONAL FIELDS
Dynamic spatial geodesy --- to determine the Earth's gravitational field by satellite trajectory analysis N81-20499
GREEN FUNCTION
A green-function method for wave interaction with a submerged body
[PB81-122269] N81-20403
Self-consistent many body theory for the standard basis operator Green's functions
[INPE-1962-RPE/275] N81-20942
GREEN WAVE EFFECT
Fundamentals of remote sensing relations between spectral signatures and physical properties of crops
[NLR-MP-79035-U] N81-20527
GREENHOUSE EFFECT
Carbon dioxide and climate: A bibliography
[DOE/TIC-3382] N81-20677
GREENHOUSES
Performance evaluation of the Balcomb solar house
[LA-UR-80-3453] N81-20586
GRINDING (MATERIAL REMOVAL)
The burr must go --- burr removal techniques in industry
[PNR-90042] N81-20442
GRINDING MACHINES
The burr must go --- burr removal techniques in industry
[PNR-90042] N81-20442
GROUND EFFECT (AERODYNAMICS)
The velocity induced by the wake of a wind turbine in a shear layer, including ground effect
[FFA-133] N81-20037
GROUND STATE
Perturbation theory approach to the ground state energy in an infinite Fermion system
[LA-UR-80-3658] N81-20848
GROUND SUPPORT SYSTEMS
Ground equipment for moving satellites and geostationary satellites --- used in the ground support function N81-20133
GROUND TRUTH
Ranking various classifications of the same data from ground truths and contingency tables --- for the reduction of multispectral band scanner image data
[ESA-CR(P)-1388] N81-20766
GROUND WATER
Groundwater heat pumps: An examination of hydrogeologic, environmental, legal, and economic factors affecting their use. Volume 2: Appendix D, state hydrogeologic descriptions and maps
[DOE/CS-20060/5120-VOL-2] N81-20398
Basin development and water allocation
[PB81-127276] N81-20534
Energy out of groundwater
[NE/HETV-80/9] N81-20565
Groundwater as an alternative energy source for space heating and cooling, geothermal heat extraction
[DOE/TIC-11357] N81-20571
GROUND WIND
A study of topographically-forced surface winds in Antarctica with special emphasis on the katabatic flow at Adelie Land N81-20655
Revised Uniform Summary of Surface Weather Observations (RUSSWO), Maui Optical Site, Mount Halekulia, Hawaii, parts C, E-F
[AD-A095328] N81-20674
Comparison of wind spectra from spatially averaged and point measurements in complex terrain
[UCRL-84546] N81-20678
Comparison of observed and predicted slope winds
[PNL-SA-8785] N81-20679
GROUND-AIR-GROUND COMMUNICATIONS
The exchange of information between a satellite and the ground for control operations, and starting up the ground system N81-20132
GROWTH
Change in energy expenditure and brain and adrenal content of catecholamines in rats during muscular loading and hypokinesia
[NASA-TM-76148] N81-20697
GUIDANCE SENSORS
Strapdown inertial optical system (SIOS) --- for observation and communication satellites
[REPT-0002/DX60] N81-20153
GUINEA PIGS
The effect of immobilization and 3 (beta-aminoethyl)-1, 2, 4 triazol on the calcium content in gastric tissues of guinea pigs during the formation of experimental ulcers
[NASA-TM-75992] N81-20691
Experimental joint immobilization in guinea pigs. Effects on the knee joint
[NASA-TM-76067] N81-20696
GUST LOADS
Wind profiles for Space Shuttle loads analysis
[NASA-CR-161676] N81-20666
GYROSCOPIC PENDULUMS
Synthesis of work concerning eddy current pendular nutation dampers. Application of theory to equipment qualification and verification on a spin simulator
[CNES-78/CT/PRT/SST/SS/197] N81-20169

H

HADRONS
Tests of dynamical supersymmetries via charged particle transfer reactions
[LA-UR-80-3476] N81-20849

HALLEY'S COMET
Comet Science Working Group report on the Halley Intercept Mission
[NASA-TM-82386] N81-20100

HALOCARBONS
High voltage research (breakdown strengths of gaseous and liquid insulators) and environmental effects of dielectric gases --- halogenated ethylene compounds
[ORNL/TM-7624] N81-20366

HALOGEN COMPOUNDS
Ultraviolet laser photochemistry of halogenated methanes
[LA-UR-80-2798] N81-20233

HALOGENATION
Permeation of protective garment material by liquid halogenated ethanes and a polychlorinated biphenyl
[LA-8572-MS] N81-20732

HAMILTON-JACOBI EQUATION
Action angle variables in classical and quantum mechanics --- a quantum analogue of classical Hamilton-Jacobi theory N81-20941

HANDBOOKS
Study on fluid phenomena influencing the design of zero-gravity experiments. Volume 2: Users' guide
[TS-11-79-VOL-2] N81-20106

HARDNESS
The microstructural and property changes of laser treated electrodeposits
[AD-A095345] N81-20254

HARDWARE UTILIZATION LISTS
Catalog of French cold gas equipment for use in space applications
[CNES-CT/PRT/SST/SE/349] N81-20313

HARMONIC GENERATIONS
Nonlinear optical effects in liquid crystals --- second-harmonic generations
[AD-A095368] N81-20934

HARMONIC MOTION
Unsteady airloads on a harmonically pitching wing with external store
[NLR-MP-80004-U] N81-20038

HAULING
Critical parameters for coarse coal underground slurry haulage systems
[JPL-PUB-81-11] N81-20495

HAWAII
Hickam AFB, Honolulu, Hawaii, revised uniform summary of Surface Weather Observations (RUSSWO), parts A-F
[AD-A095331] N81-20673
Revised Uniform Summary of Surface Weather Observations (RUSSWO), Maui Optical Site, Mount Halekulia, Hawaii, parts C, E-F
[AD-A095328] N81-20674

HEART FUNCTION
Noninvasive aortic bloodflow by Pulsed Doppler Echocardiography (PDE) compared to cardiac output by the direct Fick procedure N81-20709
Beat by beat stroke volume assessment by PDE in upright and supine exercise N81-20710
Changes in cardiac output and tibial artery flow during and after progressive LBNP N81-20712
Activity of the right cardiac ventricle and metabolism in healthy persons during an orthostatic test after short term immobilization
[NASA-TM-76519] N81-20726

HEART RATE
Specialized physiological studies in support of manned space flight
[NASA-CR-160936] N81-20707

HEAT
Heat exchange and solar energy, volume 2 --- conference proceedings, Rhode Saint Genese, Belguim
[VKI-LEC-SER-1980-2-VOL-2] N81-20549

HEAT BALANCE
Flat plate thermal solar collectors: A physical background
[PB81-135741] N81-20605

HEAT EXCHANGERS
Energy out of groundwater
[NE/HETV-80/9] N81-20565
Development of method and equipment for energy recovery from the exhaust gases of the oil-fueled smelting and holding furnaces
[STU-78-6895] N81-20573

HEAT FLUX
Optimal distribution of thermal insulation and ground heat losses
[PB81-122871] N81-20317
Basic research needed for the development of geothermal energy
[LA-8562-MS] N81-20580
Heat loss modeling for the ANL Research Solar Pond
[ANL-CT-80-22] N81-20589
Time-dependent convection N81-20993

HEAT MEASUREMENT
Thermal lens calorimetry N81-20204

HEAT OF FORMATION
Calculation of the thermodynamic properties of fuel-vapor species from spectroscopic data
[ANL-CEN-RSD-80-2] N81-20943

HEAT OF FUSION
Latent and chemical storage --- solar energy, thermochemical storage N81-20550
The benefits of advanced heat storage systems --- solar energy, phase changes, encapsulation, heat of fusion N81-20551

HEAT PUMPS
Groundwater heat pumps: An examination of hydrogeologic, environmental, legal, and economic factors affecting their use. Volume 2: Appendix D, state hydrogeologic descriptions and maps
[DOE/CS-20060/5120-VOL-2] N81-20398
Energy out of groundwater
[NE/HETV-80/9] N81-20565
Evaluation of solar collectors for heat pump applications
[DOE/CS-35351/T1] N81-20568

HEAT RESISTANT ALLOYS
Long time corrosion testing with and without mechanical stress of high temperature alloys for the blades of high output land-based gas turbines
[BMFT-FB-T-79-106] N81-20266
Examination of the strength of high temperature alloys for gas turbines in hot gas environments
[BMFT-FB-T-79-150] N81-20267
Development of an irradiation creep correlation for 20% cold-worked AISI 316 in fusion environments: DAFS contribution
[DOE/FF-02170/T58] N81-20475

HEAT SINKS
A model of the Antarctic sink for stratospheric water vapor N81-20623

HEAT STORAGE
Latent and chemical storage --- solar energy, thermochemical storage N81-20550
The benefits of advanced heat storage systems --- solar energy, phase changes, encapsulation, heat of fusion N81-20551
Performance of air collector house heating systems with rock bed storage --- solar heating N81-20553
Optimization of storage in passive solar heating systems
[DOE/CS-35405/T1] N81-20574

HEAT TRANSFER
Finned tube heat exchangers: State of the art for the air side
[CONF-800451-3] N81-20399
MARIAH: A finite element computer program for incompressible porous flow problems
[SAND-79-1623] N81-20402
SPIDA: A small program for interactive display and analysis --- stress analysis and heat transfer
[REL/R(79)28] N81-20476
Heat exchange and solar energy, volume 2 --- conference proceedings, Rhode Saint Genese, Belguim
[VKI-LEC-SER-1980-2-VOL-2] N81-20549
An asymptotic method for determining the transport of heat and matter by creeping flows with strongly variable viscosity; Fluid-dynamic problems motivated by island arc volcanism N81-20633

HEAT TRANSFER COEFFICIENTS
Resolving the heat-flow anomaly at the Galapagos Spreading Center N81-20625

HEATING EQUIPMENT
Finned tube heat exchangers: State of the art for the air side
[CONF-800451-3] N81-20399
MHD air heater development technology
[DOE/ET-15602/T2] N81-20590

HEAVY IONS
Correlation of aligned angular momentum with scattering angle and energy loss in deeply inelastic collisions
[DOE/ER-01388/464] N81-20840
Accelerator development for heavy ion fusion
[LA-UR-80-2822] N81-20859
Temperature dependences of hyperfine fields at SP-impurities in fcc-cobalt studied by nuclear spin precession following heavy-ion reactions N81-20926

HELICOPTERS
An investigation of drag associated with the upswept rear fuselage of a helicopter
[BU-257] N81-20043
Minimum operational performance standards for airborne radar approach and beacon systems for helicopters
[RTCA/DO-172] N81-20322

HELIOSTATS
Plastic film performance improvement for heliostats
[SAND-79-8185] N81-20579

HELIUM
Theoretical studies of highly ionized species
[DOE/ER-02887/2] N81-20850

HELIUM ISOTOPES
Concentration dependent thermal release of helium-3 implanted in molybdenum N81-20241
Attenuation of zero sound in liquid He(3)-A N81-20930

HEMODYNAMICS
Orthostatic hypotension
[NASA-TM-75889] N81-20728

HERMETIC SEALS
Ultrasonic weld sealing of M55 stab detonators
[AD-A095343] N81-20436

HETERODYNING
Heterodyne interferometric and moire test methods for surface measurements N81-20914
The design study of a far infrared heterodyne spectrometer assembly, volume 1 --- spaceborne applications
[ESS/CCG-118-VOL-1] N81-20989
The design study of a far infrared heterodyne spectrometer assembly, volume 2 --- power conditioner
[ESS/CCG-118-VOL-2] N81-20990

HF LASERS
A theoretical assessment of vibrational to rotational energy exchange in the hydrogen fluoride chemical laser N81-20413

HIERARCHIES
On the use of hierarchically computed 'Mexican Hat' features for texture discrimination
[AD-A095718] N81-20792

HIGH ALTITUDE
A study of high-altitude manned research aircraft employing strut-braced wings of high-aspect-ratio
[NASA-CR-159262] N81-20067

HIGH ALTITUDE BALLOONS
Thin film strain transducer --- in-flight measurement of stress or strain in walls of high altitude balloons
[NASA-CR-156875] N81-20406

HIGH ALTITUDE ENVIRONMENTS
Casting procedure for barium metal cones used in high-altitude experiments --- reusable graphite molds
[LA-8517-MS] N81-20260

HIGH ASPECT RATIO
A study of high-altitude manned research aircraft employing strut-braced wings of high-aspect-ratio
[NASA-CR-159262] N81-20067

HIGH ENERGY INTERACTIONS
Study of direct single photons and correlated particles in proton-proton collisions at square roots = 62-4 GeV (CCOR collaboration)
[DOE/ER-02232/94] N81-20842
Measurement of the transverse momenta of partons and of jet fragmentation as a function of square roots in p-p collisions: CCOR Collaboration
[DOE/ER-02232/92] N81-20853
FASTBUS system used in a high energy experiment
[BNL-28613] N81-20855
Proceedings of the Beam-Beam Interaction Seminar
[SLAC-PUB-2624] N81-20856
Semiconductor devices as track detectors in high energy colliding beams experiments
[BNL-28850] N81-20861

HIGH FREQUENCIES
RACE: An automatic high frequency radio telephone system for communications in remote areas [CRC-1338-E] N81-20326
An investigation of high frequency propagation over an auroral sub-auroral path --- prediction of usable frequencies [RAE-TM-RAD-NAV-138] N81-20350
High-frequency sound propagation in a spatially varying mean flow [NASA-TM-81751] N81-20831
HIGH LEVEL LANGUAGES
ADA test and evaluation [AD-A095699] N81-20747
Proceedings of the ADA Debut [AD-A095569] N81-20751
HIGH POWER LASERS
Study of chemical reactions and energy transfer for high-energy and high-power lasers [AD-A095706] N81-20414
LASL Free Electron Laser experiment [LA-UR-80-3187] N81-20420
HIGH RESOLUTION
The high resolution imaging atom-probe with application to nickel platings [AD-A095254] N81-20251
HIGH SPEED
Short transit time photoconductive detectors for high speed optical communication N81-20320
High speed cylindrical roller bearing development [AD-A095357] N81-20437
HIGH STRENGTH ALLOYS
Naval structural materials: Requirements, issues, and opportunities [AD-A095724] N81-20466
HIGH STRENGTH STEELS
Forging of powder metallurgy gears [AD-A095556] N81-20247
HIGH TEMPERATURE ENVIRONMENTS
The enzyme spectrum of the small intestine with hypodynamia under conditions of high temperature [NASA-TM-76150] N81-20727
HIGH TEMPERATURE LUBRICANTS
Dry lubrication of high temperature silicon nitride rolling contacts [AD-A095202] N81-20435
HIGH TEMPERATURE RESEARCH
Mechanisms of elevated temperature rupture in single phase ceramics [DOE/ER-10591/1] N81-20280
High temperature properties of different SiC materials: Creep behavior [BMFT-FB-T-79-157] N81-20478
HIGH TEMPERATURE TESTS
Investigation of fabrication, composition and properties of new high temperature ceramics based on silicon nitride [BMFT-FB-T-79-174] N81-20283
HIGH VOLTAGES
High voltage, low inductance hydrogen thyratron study program [AD-A095278] N81-20364
High voltage research (breakdown strengths of gaseous and liquid insulators) and environmental effects of dielectric gases --- halogenated ethylene compounds [ORNL/TM-7624] N81-20366
Design, construction and testing of a dc bioeffects test enclosure for small animals --- simulating the environment of high voltage dc transmission lines [DOE/RA-10157/1] N81-20702
HISTOGRAMS
Real-time grey-level histogram manipulation N81-20807
HISTORIES
Beyond the atmosphere: Early years of space science [NASA-SP-4211] N81-20962
The meaning of space science N81-20963
The context --- technological spinoffs from aerospace research N81-20964
Prophets and pioneers of spaceflight N81-20965
The rocket and satellites research panel: The first space scientists N81-20966
The Academy of Sciences stakes a claim N81-20967
Early harvest: The upper atmosphere and cosmic rays N81-20968
Response to Sputnik: The creation of NASA N81-20969
NASA gets under way N81-20970
Deepening perspective: A new look at the old world --- satellites and the earth sciences N81-20973
Who decides? --- program proposals; relations between NASA and the scientific community N81-20974
The universities: Allies and rivals to NASA N81-20975
Programs, projects, and headaches --- NASA central program management and the field centers N81-20976
Jet Propulsion Laboratory: Outsider or insider? N81-20977
Leadership and changing times --- nasa management N81-20979
Objectives, plans, and budgets --- nasa programs N81-20983
HMX
Analysis of RDX and HMX in PBX 9404 by high performance liquid chromatography [MHSMP-80-55] N81-20307
HOLMIUM ISOTOPES
Correlation of aligned angular momentum with scattering angle and energy loss in deeply inelastic collisions [DOE/ER-01388/464] N81-20840
HOLOGRAPHIC INTERFEROMETRY
Phase control during reconstruction of holographically recorded flow fields using real-time holographic interferometry [NASA-TM-81953] N81-20405
HONEYCOMB STRUCTURES
Evaluation of the behavior of structures made of high modulus composite materials when struck by lightning [NASA-TM-75866] N81-20188
HOT ATOMS
Hot atom reactions involving multivalent and univalent species --- recoil (31)Si reactions [DOE/ER-03898/52] N81-20854
HOT CORROSION
Examination of the strength of high temperature alloys for gas turbines in hot gas environments [BMFT-FB-T-79-150] N81-20267
HOT ELECTRONS
Electron heating in a high voltage toroidal theta pinch N81-20884
HOT-FILM ANEMOMETERS
A feasibility study of an instrument for measuring wind speed employing vortex shédding [BU-254] N81-20411
HOT-WIRE ANEMOMETERS
Turbulence measurements in supersonic flows --- hot-wire versus laser anemometry N81-20392
Measurements of the transverse velocity of a separating turbulent boundary layer --- wind tunnel tests [AD-A095256] N81-20395
HOT-WIRE FLOWMETERS
Hot wire techniques: Conditional sampling and intermittency --- measurement of turbulent flows N81-20393
HOVERING
An extension of the local momentum theory to a distorted wake model of a hovering rotor [NASA-TM-81258] N81-20030
HUMAN REACTIONS
Annoyance from light aircraft investigation conducted around four airports near Paris [NASA-TM-76532] N81-20609
HUMIDITY
Davison AAF, Ft. Belvoir Virginia, Revised Uniform Summary of Surface Weather Observations (RUSSWO), parts A-F [AD-A095332] N81-20672
Portland IAP, Portland, Oregon, Revised Uniform Summary of Surface Weather Observations (RUSSWO), parts A-F [AD-A095329] N81-20675
HURRICANES
Current-wave spectra coupling project, volume 4. Part A: Formulation of the three-dimensional structure of storm-generated currents. Part B: Summaries of volumes 1, 2 and 3 --- hurricane conditions at potential otec sites [DOE/SF-20235/T1-VOL-4] N81-20689
HYBRID CIRCUITS
Development of hybrid circuits --- based on thick film technology [DH-RS-01] N81-20374
HYBRID STRUCTURES
Damage tolerance of hybrid structures --- crack propagation in aluminum alloy sheet reinforced by four unidirectional fiber/epoxy strips [BMVG-FBWT-79-27] N81-20477
HYDRAULIC EQUIPMENT
Optimal risk-based design of water resource engineering projects [PB81-136202] N81-20316
HYDRIDES
Kinetics of hydrogen absorption-desorption by metals [BNL-28584] N81-20259
HYDROCARBON COMBUSTION
Comparison of gas phase hydrocarbon emissions from light-duty gasoline vehicles and light-duty vehicles equipped with diesel engines [PB81-122996] N81-20620
HYDROCARBON FUELS
Office of alcohol fuels program plan, FY 1981 [DOE/AF-10001/T2] N81-20293
Conversion of cellulosic wastes to liquid fuels [COO-2982-57] N81-20306
HYDROCARBONS
Catalytic synthesis of hydrocarbons over group 8 of the reaction mechanism metals: A discussion [LBL-11339] N81-20230
HC quench layer formation in combustion processes [DOE/ET-15303/T5] N81-20236
Flash pyrolysis and hydropyrolysis of coal [BNL-28577] N81-20301
Far-ultraviolet spectral and spatial imaging of Jupiter and Saturn N81-20987
HYDRODYNAMIC EQUATIONS
Hydrodynamic pressure and added mass for axisymmetric bodies --- finite element method [PB81-122343] N81-20404
HYDROFLUORIC ACID
A theoretical assessment of vibrational to rotational energy exchange in the hydrogen fluoride chemical laser N81-20413
HYDROGEN
Catalytic synthesis of hydrocarbons over group 8 of the reaction mechanism metals: A discussion [LBL-11339] N81-20230
The high resolution imaging atom-probe with application to nickel platings [AD-A095254] N81-20251
Response of selected microorganisms to experimental planetary environments [NASA-CR-164064] N81-20733
Theoretical studies of highly ionized species [DOE/ER-02887/2] N81-20850
Virgo cluster galaxies: Neutral hydrogen studies N81-20991
A study of the interstellar medium in NGC 185 and other early-type galaxies N81-20992
HYDROGEN BONDS
Hydrogen bonding in asphaltenes and coal liquids [DOE/PC-30252/T1] N81-20227
HYDROGEN CHLORIDES
A study of gas solid reactions and air pollution detectors [AD-A095253] N81-20610
HYDROGEN EMBRITTLEMENT
Effects of hydrogen on the elastic constants of vanadium and palladium single crystals N81-20242
Studies of hydrogen embrittlement and stress-corrosion cracking in an aluminum-zinc-magnesium alloy [DOE/ER-01198/1325] N81-20256
The delayed fracture of aluminum alloys --- stress corrosion cracking [AD-A095732] N81-20468
HYDROGEN PLASMA
Ion heating in the ion cyclotron range of frequencies in the Wisconsin Tokapole 2 N81-20880
HYDROGEN PRODUCTION
Improvements in the electrolytic generation of hydrogen N81-20287
Improvement of the electrolytic process of hydrogen production [EUR-6764-FR] N81-20299
Review of fusion synfuels [BNL-28627] N81-20300
HYDROGEN SULFIDE
A study of gas solid reactions and air pollution detectors [AD-A095253] N81-20610

Response of selected microorganisms to experimental planetary environments
[NASA-CR-164064] N81-20733

HYDROGEOLOGY
Groundwater heat pumps: An examination of hydrogeologic, environmental, legal, and economic factors affecting their use. Volume 2: Appendix D, state hydrogeologic descriptions and maps
[DOE/CS-20060/5120-VOL-2] N81-20398

HYDROLOGY
Optimal risk-based design of water resource engineering projects
[PB81-136202] N81-20316
Indiana five-year water resources research and development plan. Fiscal years 1982 - 1986 --- hydrologic setting and water resource utilization
[PB81-121253] N81-20621

HYDROPYROLYSIS
Flash pyrolysis and hydropyrolysis of coal
[BNL-28577] N81-20301

HYDROTHERMAL SYSTEMS
Comparative assessment of five potential sites for hydrothermal-magma systems: Summary
[DOE/TIC-11303] N81-20525
Resolving the heat-flow anomaly at the Galapagos Spreading Center N81-20625

HYDROXYL RADICALS
Measurement of the line reversal temperature of OH in CH4/N2 O flames
[AD-A095349] N81-20408

HYPERSONIC AIRCRAFT
Aerodynamic characteristics of a hypersonic cruise aircraft concept with wing-mounted propulsion systems at Mach numbers of 2.96, 3.96 and 4.63 --- Langley unitary plan wind tunnel tests
[NASA-TM-81937] N81-20025

HYPODYNAMIA
Effect of inaction on function of fast and slow muscle spindles
[NASA-TM-76374] N81-20720
The enzyme spectrum of the small intestine with hypodynamia under conditions of high temperature
[NASA-TM-76150] N81-20727

HYPOKINESIA
Change in energy expenditure and brain and adrenal content of catecholamines in rats during muscular loading and hypokinesia
[NASA-TM-76148] N81-20697
Effect of six-month hypokinesia in dogs on mineral component, reconstruction and mechanical properties of bone tissue
[NASA-TM-76168] N81-20698
Functional-morphological parallels of the hypothalamo-pituitary-adrenal system response reaction to long-term hypokinesia
[NASA-TM-76001] N81-20716
The functional status of the human vestibular analysor following 56 days in an aqueous immersion medium
[NASA-TM-75888] N81-20725

HYPOTENSION
Orthostatic hypotension
[NASA-TM-75889] N81-20728

HYPOTHALAMUS
Functional-morphological parallels of the hypothalamo-pituitary-adrenal system response reaction to long-term hypokinesia
[NASA-TM-76001] N81-20716

HYPOXIA
Comparison of early reactions of the blood system in rats to immobilization, the action of hypoxia and the administration of erythopoietin
[NASA-TM-76169] N81-20699
Hypoxia in the walls of large blood vessels N81-20706

I

ICE
New observations on the daily variations of natural ice albedo
[PB81-132789] N81-20532

ICE MAPPING
Radar investigations of the Ross Ice Shelf N81-20631

ICE REPORTING
Radar investigations of the Ross Ice Shelf N81-20631

IDEAL FLUIDS
A spin coefficient approach to Weyssenhoff fluids in Einstein-Cartan theory
[MATH-RES-153] N81-20801

IGNITION
Ignition of a liquid fuel under high intensity radiation
[AD-A095691] N81-20223
Approach to ignition of Tokamak reactors
[ORNL/TM-7552] N81-20897

IGNITION TEMPERATURE
Explosibility of energetic material dusts
[AD-A095353] N81-20288

IMAGE CONVERTERS
Analog rectification --- transformation of a council perspective (remote sensor imagery) into an orthogonal cylindrical perspective (map) N81-20516

IMAGE CORRELATORS
Technical demonstration: Apparatus for locating landmarks --- on images N81-20523

IMAGE ENHANCEMENT
Orthophotography and numerical terrain models --- of aerial imagery N81-20506
Geometrical correction of images: Methods and performance N81-20517
Real-time grey-level histogram manipulation N81-20807
Image enhancement in real time N81-20813

IMAGE PROCESSING
Autonomous acquisition simulator and associated data
[AD-A095709] N81-20145
Quantitative ion microscopy by digital image processing N81-20205
ARI image interpretation research 1970 - 1980
[AD-A095661] N81-20344
Applications of CCD and SAW devices to image processing N81-20357
Identification of irrigation practices using photographic and optical-mechanical scanning remote sensing techniques N81-20487
Digital processing of remotely sensed images
[NASA-SP-431] N81-20489
Radiometric degradation of images and ground preprocessing --- of imagery received from remote sensors N81-20513
Processing radiometric data for cartography N81-20518
The SPOT satellite image processing facility in Toulouse and its capabilities N81-20520
Technical demonstration: An interactive system for image processing N81-20521
Ionization and emission processes in the auroral and equatorial ionosphere --- support services for operation and data analysis
[AD-A095296] N81-20647
Performance of the discrete Fourier Transform satellite imagery classification technique
[AD-A095364] N81-20670
Image processing
[AD-A095552] N81-20764
On the use of hierarchically computed 'Mexican Hat' features for texture discrimination
[AD-A095718] N81-20792
Image and Sensor Data Processing for Target Acquisition and Recognition
[AGARD-CP-290] N81-20803
Target detection and classification in infrared imagery N81-20806
Image processing techniques using spline approximation N81-20809
A flexible image processing system N81-20810
Assistance in interpreting satellite multispectral imagery N81-20811
Research into methods of image processing for target enhancement and detection N81-20812
Semi-Automatic and automatic extraction of objects from aerial images N81-20814
Numerical target tracking N81-20817
Digital image processing for ground target detection, identification and location N81-20824
A system look at real time processing for target acquisition and classification N81-20825
Prototype automatic target screener
[AD-A095596] N81-20869
Far-ultraviolet spectral and spatial imaging of Jupiter and Saturn N81-20987

IMAGE RECONSTRUCTION
Apparatus for reconstruction --- of photogrammetric data; operational specifications N81-20505
Positioning SPOT images: Reconstitution from a stereoscopic pair --- and photogrammetric implications N81-20510
Technical demonstration: A high density image visualization system --- for producing a photographic print from video data N81-20522

IMAGE RESOLUTION
General reflections --- on spacecraft motion and its influence on the geometric quality of imagery N81-20500
Geometrical quality of scanning sensor imagery --- from earth satellites N81-20501

IMAGERY
LAPR: An experimental aircraft pushbroom scanner
[NASA-TM-80729] N81-20493

IMAGES
The high resolution imaging atom-probe with application to nickel platings
[AD-A095254] N81-20251
The localization of reference points --- on images and associated digital methodology N81-20514
Models of deformation --- introduced by the transformation of terrain coordinates into image coordinates N81-20515

IMAGING TECHNIQUES
Elemental distributions of biological materials by ion microscopy N81-20211
Image restoration parameter choice: A quantitative guide
[AD-A095708] N81-20446
Digital processing of remotely sensed images
[NASA-SP-431] N81-20489
Spaceborne scanners for photoelectric detection N81-20508
A TV-tracking system based on computer intelligence N81-20816
Target tracking using area correlation N81-20818
A real-time video tracking system based on Bayes rule N81-20819
Target tracking and target detection in TV- and FLIR-imagery N81-20820
Target identification of aircraft using IR/TV-sensor-images N81-20821
Autonomous target screeners N81-20822
Ultrasonic imaging with narrow beam insonification across a fluid-metal interface N81-20827
Quantitative schlieren analysis of acoustic interaction with submerged plates N81-20828
Solid state imagers --- imaging and image storage
[BMFT-FB-T-80-009] N81-20875

IMBEDDINGS (MATHEMATICS)
An application of the embedded grid technique to the calculation of transonic flow past wings --- Cartesian grids and programming
[FFA-TN-AU-1600] N81-20036

IMMOBILIZATION
The effect of immobilization and 3 (beta-aminoethyl)-1, 2, 4 triazol on the calcium content in gastric tissues of guinea pigs during the formation of experimental ulcers
[NASA-TM-75992] N81-20691
Changes in mast cells and in permeability of mesenteric microvessels under the effect of immobilization and electrostimulation
[NASA-TM-75988] N81-20694
Morphological changes in neurons of the hind limb reflex arc during long term immobilization
[NASA-TM-75939] N81-20695
Experimental joint immobilization in guinea pigs. Effects on the knee joint
[NASA-TM-76067] N81-20696
Comparison of early reactions of the blood system in rats to immobilization, the action of hypoxia and the administration of erythopoietin
[NASA-TM-76169] N81-20699
Activity of the right cardiac ventricle and metabolism in healthy persons during an orthostatic test after short term immobilization
[NASA-TM-76519] N81-20726

IMMUNOLOGY
Laser fluorescence immunoassay N81-20206

IMPACT ACCELERATION
Computational aspects of incorporating auxiliary information into an impact acceleration injury prediction model
[AD-A095299] N81-20730

IMPACT DAMAGE
Platelet mechanism of erosion of ductile metals
[LBL-11341-REV] N81-20261

IMPACT PREDICTION
Computational aspects of incorporating auxiliary information into an impact acceleration injury prediction model
[AD-A095299] N81-20730
IMPACT RESISTANCE
Toughening of epoxy resin by acrylic elastomer N81-20273
Safety and characterization tests on HIVELITE composition 300435
[AD-A095352] N81-20291
IMPINGEMENT
Investigation into the behavior of titanium and titanium alloys under cavitational stress --- droplet impinger
[GEC-TRANS-2071] N81-20265
IMPLANTATION
Concentration dependent thermal release of helium-3 implanted in molybdenum N81-20241
IMPLANTED ELECTRODES (BIOLOGY)
Surgical access to separate branches of the cat vestibular nerve
[NASA-TM-76478] N81-20715
IMPURITIES
A study of impurity transport with an EUV spatial imaging detector system on the Alcator A Tokamak N81-20878
Electronic properties associated with donor impurities in multivalley semiconductors --- silicon, germanium and gallium phosphites N81-20917
Temperature dependences of hyperfine fields at SP-impurities in fcc-cobalt studied by nuclear spin precession following heavy-ion reactions N81-20926
IN-FLIGHT MONITORING
On contributions to the 10th Symposium on Aircraft Integrated Data Systems (AIDS) --- Aachen, 26-27 Mar. 1980
[DFVLR-MITT-80-09] N81-20007
Digital filtering of PCM-recorded flight data for wind-processing N81-20009
Wind shear measuring on board an airliner N81-20011
Individual jet engine stress load monitoring with the aid of the flight data recording system LEADS 200 N81-20013
Uses of AIDS data in airlines engine maintenance N81-20016
The A310 Aircraft Integrated Data System (AIDS) N81-20017
Possible online uses of AIDS data in future ATC systems N81-20018
Natural nutation damping due to the ergols of the hot gaz propulsion system. Synthesis of MV1 and MV2 in-flight results
[CNES-79/CT/PRT/SST/SS/166] N81-20170
INCIDENT RADIATION
Current sheet model N81-20331
INCOMPRESSIBLE FLOW
MARIAH: A finite element computer program for incompressible porous flow problems
[SAND-79-1623] N81-20402
INCONEL (TRADEMARK)
Turbine materials characteristics under low cycle fatigue --- turbine engine disk life
[BMFT-FB-T-79-151] N81-20268
Welding of nickel alloys --- including Inconel and waspaloy
[BMFT-FB-T-79-180] N81-20443
INDEPENDENT VARIABLES
Critical parameters for coarse coal underground slurry haulage systems
[JPL-PUB-81-11] N81-20495
Simulated lumped-parameter system reduced-order adaptive control studies
[NASA-CR-163992] N81-20760
INDEXES (DOCUMENTATION)
Defense Technical Information Center referral data bank directory, Edition No. 8
[AD-A095600] N81-20952
INDIAN OCEAN
Geophysical investigations of the southern continental margin of Australia and the conjugate sector of East Antarctica N81-20632
INDIANA
Indiana five-year water resources research and development plan. Fiscal years 1982 - 1986 --- hydrologic setting and water resource utilization
[PB81-121253] N81-20621
INDIUM
Ultrasonic attenuation in normal and superconducting indium N81-20918
INDIUM ALLOYS
A heat pulse study of superconducting lead/indium alloys N81-20921
INDIUM PHOSPHIDES
Semiconductor devices for optical communications in 1 micron band of wavelength --- gallium indium arsenide phosphide lasers and diodes
[NASA-TM-75869] N81-20867
INDUSTRIAL ENERGY
Study of the potential for cogeneration in Canada: Industrial steam turbines. Volume 2: Economic potential
[NP-25187-VOL-2] N81-20564
INDUSTRIAL PLANTS
Coal hydrogasification process development
[DOE/ET-10328/27] N81-20304
INDUSTRIAL WASTES
Water resources in North Carolina
[PB81-127318] N81-20533
The 1979 Southeastern Virginia Urban Plume Study. Volume 2: Data listings for NASA Cessna aircraft
[NASA-TM-81860-2] N81-20608
INELASTIC COLLISIONS
Correlation of aligned angular momentum with scattering angle and energy loss in deeply inelastic collisions
[DOE/ER-01388/464] N81-20840
INELASTIC SCATTERING
Atomic inner-shell processes
[AD-A095415] N81-20837
Correlation of aligned angular momentum with scattering angle and energy loss in deeply inelastic collisions
[DOE/ER-01388/464] N81-20840
INELASTIC STRESS
Cyclic inelastic buckling of tubular steel braces
[PB81-124885] N81-20484
INERTIAL CONFINEMENT FUSION
Laser-initiated, reduced density channels for transporting charged particle beams
[AD-A095725] N81-20415
INERTIAL FUSION (REACTOR)
Inertial fusion program
[LA-7755-PR] N81-20901
INERTIAL PLATFORMS
Error analysis and performance data from an automated azimuth measuring system
[AD-A095446] N81-20057
INERTIAL REFERENCE SYSTEMS
Space and time reference systems N81-20111
INERTIAL UPPER STAGE
Shuttle/payload communications and data systems interface analysis: Executive summary
[NASA-CR-160929] N81-20158
INFINITY
Infinite frequency interpretations of minimal bases --- factorizations of rational matrices
[MATH-RES-148] N81-20783
INFORMATION DISSEMINATION
Defense Technical Information Center referral data bank directory, Edition No. 8
[AD-A095600] N81-20952
INFORMATION MANAGEMENT
Logical channel theory
[AD-A095683] N81-20737
The Data from Aeromechanics Test and Analytics, Management and Analysis Package (DATAMAP). Volume 1: User's manual
[AD-A095188] N81-20745
INFORMATION RETRIEVAL
Conceptual information retrieval
[AD-A095372] N81-20765
Advanced Query Facility
[AD-A095717] N81-20950
INFORMATION SYSTEMS
Fundamental understanding of matter: An engineering viewpoint
[LA-UR-80-3585] N81-20181
A watershed information system
[PB81-127433] N81-20528
Materials data retrieval at ESTEC --- for spacecraft construction
[ESA-STM-206] N81-20954
INFORMATION THEORY
Conceptual information retrieval
[AD-A095372] N81-20765
Memory, meaning and syntax
[AD-A095451] N81-20951
INFRARED DETECTORS
Advanced methods for preparation and characterization of infrared detector materials --- mercury cadmium tellurides
[NASA-CR-161598] N81-20863
Prototype automatic target screener
[AD-A095596] N81-20869
INFRARED IMAGERY
ARI image interpretation research 1970 - 1980
[AD-A095661] N81-20344
Image and Sensor Data Processing for Target Acquisition and Recognition
[AGARD-CP-290] N81-20803
Target detection and classification in infrared imagery N81-20806
Research into methods of image processing for target enhancement and detection N81-20812
Target identification of aircraft using IR/TV-sensor-images N81-20821
Autonomous target screeners N81-20822
INFRARED SCANNERS
An approach to airborne infrared search set performance modeling N81-20805
INFRARED SPECTRA
Infrared intensities of alcohols and ethers N81-20197
Infrared spectra of some sulfides and their analogs of binary composition in the long-wave region
[NASA-TM-75901] N81-20217
INFRARED SPECTROSCOPY
Fourier transform infrared spectroscopic studies on the thermal degradation of polyacrylonitrile copolymers
[AD-A095270] N81-20277
INFRARED TELESCOPES
GIRL: German Infrared Laboratory. Telescope study, phase B
[NASA-TM-75911] N81-20866
INHOMOGENEITY
Defects in galvanized products. An inspection guide
[PB81-123671] N81-20452
INJECTION
Formation of compact toroidal plasmas by magnetized coaxial plasma gun injection into an oblate flux conserver
[UCRL-85122] N81-20895
INJECTION GUIDANCE
Positioning a geostationary satellite N81-20127
INJECTION LASERS
Development of components for optical communications with light guiding fibers
[BMFT-FB-T-80-006] N81-20874
INJURIES
Computational aspects of incorporating auxiliary information into an impact acceleration injury prediction model
[AD-A095299] N81-20730
INLET FLOW
Dynamics of cavitating cascades --- transfer functions
[NASA-CR-161673] N81-20382
INORGANIC COMPOUNDS
Survey of electrochemical production of inorganic compounds --- production of synthetic fuels
[ANL/OEPM-80-3] N81-20226
Plasma chemistry for inorganic materials
[NASA-TM-75844] N81-20889
INSERTION
Cermet-bonded metal pins for weldable electrical feedthroughs in alumina
[MLM-2796(OP)] N81-20279
INSOLATION
Handbook for calculating solar-influenced building heat losses
[SAND-79-2173] N81-20583
INSPECTION
Evaluation of nondestructive inspection methods applied to milled step-down areas. Volume 1: Text and tables --- in aluminum alloys
[NLR-TR-78110-U-VOL-1] N81-20450
Evaluation of nondestructive inspection methods applied to milled step-down areas. Volume 2: Figures --- in aluminum alloys
[NLR-TR-78110-U-VOL-2] N81-20451
Defects in galvanized products. An inspection guide
[PB81-123671] N81-20452

Hybrid approaches and industrial applications of pattern recognition
[AD-A095562] N81-20763

INSULATION
Development and validation of cryogenic foam insulation for LH2 subsonic transports
[NASA-CR-3404] N81-20312

INSULATORS
High voltage research (breakdown strengths of gaseous and liquid insulators) and environmental effects of dielectric gases --- halogenated ethylene compounds
[ORNL/TM-7624] N81-20366

INTAKE SYSTEMS
Design of nonrotating parts --- in steam turbines N81-20428

INTEGRATED CIRCUITS
Microelectronics availability for the Army's missiles
[AD-A095379] N81-20152
Combination of integrated injection logic (IIL) for UHF analog circuitry
[BMFT-FB-T-80-010] N81-20371
FASTBUS system used in a high energy experiment
[BNL-28613] N81-20855
Modular file-structured databasing system
[SAND-80-2336C] N81-20953

INTEGRATED OPTICS
Solid state imagers --- imaging and image storage
[BMFT-FB-T-80-009] N81-20875
Integrated thin-film light modulation lines and matrices
[BMFT-FB-T-80-013] N81-20877

INTENSITY
Infrared intensities of alcohols and ethers N81-20197

INTERACTIONS
Study of interaction between solar arrays and attitude - orbit control. Volume 1: Technical Report
[ESS/SS-987-VOL-1] N81-20603

INTERCALATION
Experimental and theoretical studies of donor-type graphite intercalated compounds
[AD-A095282] N81-20935

INTERGRANULAR CORROSION
The delayed fracture of aluminum alloys --- stress corrosion cracking
[AD-A095732] N81-20468

INTERMITTENCY
Hot wire techniques: Conditional sampling and intermittency --- measurement of turbulent flows N81-20393

INTERNAL COMBUSTION ENGINES
Comparison of gas phase hydrocarbon emissions from light-duty gasoline vehicles and light-duty vehicles equipped with diesel engines
[PB81-122996] N81-20620

INTERNATIONAL COOPERATION
The 1981 Budget of the German Federal Ministry for Research and Technology
[NASA-TM-76493] N81-20956
Global future: Time to act. Report to the President on global resources, environment and population N81-20957
International ties --- international cooperation in the space sciences N81-20980

INTERNATIONAL GEOPHYSICAL YEAR
The Academy of Sciences stakes a claim N81-20967

INTERNATIONAL MAGNETOSPHERIC STUDY
Magnetospheric sounding rocket program: The magnetometer experiment in the substorm phenomena payload
[BMFT-FB-W-79-34] N81-20649

INTERPLANETARY MAGNETIC FIELDS
On the complex state of the interplanetary medium of 28-29 July 1977
[NASA-TM-82095] N81-20996
Fine-scale characteristics of interplanetary sector
[NASA-TM-82281] N81-20997

INTERPLANETARY NAVIGATION
Interplanetary orbit control N81-20137

INTERPLANETARY SPACECRAFT
Interplanetary missions: Upcoming technological aspects --- solar sails and solar electric propulsion N81-20138

INTERPLANETARY TRAJECTORIES
The calculation of interplanetary trajectories --- for spacecraft N81-20136

INTERPLANETARY TRANSFER ORBITS
Interplanetary orbit control N81-20137

INTERSTELLAR GAS
A study of the interstellar medium in NGC 185 and other early-type galaxies N81-20992

INTERSTELLAR MATTER
A study of the interstellar medium in NGC 185 and other early-type galaxies N81-20992

INTERVERTEBRAL DISKS
The viscoelastic behavior of the human intervertebral disc N81-20705

INTESTINES
The enzyme spectrum of the small intestine with hypodynamia under conditions of high temperature
[NASA-TM-76150] N81-20727

INVERTED CONVERTERS (DC TO AC)
Evaluation of battery converters based on 4.8-MW fuel cell demonstrator inverter
[DOE/RA-26961/01] N81-20575

INVISCID FLOW
Theoretical studies of three dimensional transonic flow through a compressor blade row
[AD-A095707] N81-20035

ION ACCELERATORS
Accelerator development for heavy ion fusion
[LA-UR-80-2822] N81-20859

ION ATOM INTERACTIONS
Theoretical studies of highly ionized species
[DOE/ER-02887/2] N81-20850

ION BEAMS
Laser-initiated, reduced density channels for transporting charged particle beams
[AD-A095725] N81-20415
One-dimensional space-charge neutralization of the ion beams
[SAND-80-2545] N81-20844
Accelerator development for heavy ion fusion
[LA-UR-80-2822] N81-20859

ION DENSITY (CONCENTRATION)
About the parametric interplay between ionic Mach number, body-size and satellite potential in determining the ion depletion in the wake of the S3-2 satellite
[AD-A095507] N81-20149

ION ENGINES
Simplified power supplies for ion thrusters
[NASA-TM-81725] N81-20177

ION EXCHANGING
Studies in chemical ionization mass spectrometry N81-20208

ION IMPLANTATION
Passivation of carbon steel through mercury implantation
[NASA-CR-165292] N81-20244
Temperature dependences of hyperfine fields at SP-impurities in fcc-cobalt studied by nuclear spin precession following heavy-ion reactions N81-20926
Ion implantation of krypton in sputter-deposited metal matrices --- storing krypton 85
[PNL-SA-8661] N81-20939

ION MICROSCOPES
Quantitative ion microscopy by digital image processing N81-20205
Elemental distributions of biological materials by ion microscopy N81-20211

ION MOTION
Simulation studies of the stability of weak and strong ion layers and rings N81-20882

ION PLATING
Sputtering and ion plating for aerospace applications
[NASA-TM-81726] N81-20424

ION PROPULSION
Extended operating range of the 30-cm ion thruster with simplified power processor requirements
[NASA-TM-81729] N81-20179
Study on additional propellants for field emission thrusters --- ion propulsion propellant properties
[FRI-R664] N81-20309

ION SOURCES
Recent work on an RF ion thruster
[NASA-TM-81734] N81-20178
Passivation of carbon steel through mercury implantation
[NASA-CR-165292] N81-20244

ION TEMPERATURE
Ion heating in the ion cyclotron range of frequencies in the Wisconsin Tokapole 2 N81-20880

IONIC COLLISIONS
Study of the ionization of C, N, O, Nr, Kr and Xe positive ions by electron impact
[ORNL-TR-4702] N81-20841

IONIC REACTIONS
Theoretical studies of highly ionized species
[DOE/ER-02887/2] N81-20850

IONIZATION
Studies in chemical ionization mass spectrometry N81-20208
Atomic inner-shell processes
[AD-A095415] N81-20837
Theoretical studies of highly ionized species
[DOE/ER-02887/2] N81-20850

IONIZATION CROSS SECTIONS
Study of the ionization of C, N, O, Nr, Kr and Xe positive ions by electron impact
[ORNL-TR-4702] N81-20841
Theoretical studies of highly ionized species
[DOE/ER-02887/2] N81-20850

IONIZATION FREQUENCIES
Recent work on an RF ion thruster
[NASA-TM-81734] N81-20178

IONOSPHERIC DISTURBANCES
About the parametric interplay between ionic Mach number, body-size and satellite potential in determining the ion depletion in the wake of the S3-2 satellite
[AD-A095507] N81-20149

IONOSPHERIC PROPAGATION
Tropospheric/ionospheric transmission tests N81-20335
A mathematical model for how ionospheric reflection degrades sea-echo spectra
[PB81-108359] N81-20652

IRIDIUM ISOTOPES
Tests of dynamical supersymmetries via charged particle transfer reactions
[LA-UR-80-3476] N81-20849

IRRADIATION
Tests of dynamical supersymmetries via charged particle transfer reactions
[LA-UR-80-3476] N81-20849

IRRIGATION
Identification of irrigation practices using photographic and optical-mechanical scanning remote sensing techniques N81-20487

ISLANDS
HF (High Frequency) radar measurements of circulation in the Eastern Strait of Juan de Fuca near Protection Island (July 1979)
[PB81-127490] N81-20690

ISOTHERMAL FLOW
Finite element simulations of stratified flow over simple geometrical obstructions and arbitrarily complex terrain N81-20607

ISOTHERMAL PROCESSES
Forging of powder metallurgy gears
[AD-A095556] N81-20247

ISOTOPIC LABELING
Concentration dependent thermal release of helium-3 implanted in molybdenum N81-20241

ITALY
Consultation for the H2S and meteorological monitoring program of the Ente Nazional per l'Energia Electtrica (ENEL)
[DOE/ET-28502/1] N81-20680

ITERATION
A general dynamic synthesis for complex structures composed of substructures N81-20455

ITERATIVE SOLUTION
Collocation method for the solution of the neutron transport equation with both symmetric and asymmetric scattering
[SAND-80-1446] N81-20843

J

JET AIRCRAFT
Delta electrical load analysis C-141B JACC/CP Aircraft
[AD-A095659] N81-20071
Stress analysis of aircraft modifications (C-141B Aircraft). Joint Airborne Communications Center/Command Post (JACC/CP) provisions
[AD-A095634] N81-20072

JET AIRCRAFT NOISE
NASA progress in aircraft noise prediction
[NASA-TM-81915] N81-20830

JET ENGINES
Issues of commonality. Volume 2: Issue analysis [AD-A095418] N81-20046
Issues of commonality. Volume 1: Executive summary [AD-A095417] N81-20047
The optimum design of by-pass engines with jet mixing [PNR-90017] N81-20081
Electromagnetic scattering by open circular waveguides --- modeling jet engine inlets [AD-A095554] N81-20345

JET IMPINGEMENT
Simulation of aeroheating or aerocooling Air Force stores by arrays of impinging jets [AD-A095464] N81-20034

JET MIXING FLOW
The optimum design of by-pass engines with jet mixing [PNR-90017] N81-20081

JOINTS (JUNCTIONS)
Scarf joints in unidirectional carbon fiber reinforced plastics --- tests of repairs made using adhesives [BU-258] N81-20193

JUPITER (PLANET)
Far-ultraviolet spectral and spatial imaging of Jupiter and Saturn N81-20987
Radio Jupiter after Voyager: An overview of the Planetary Radio Astronomy observations [NASA-TM-80718] N81-20988

K

KALMAN FILTERS
Orbit determination: Statistical methods N81-20116
Determination of the degree of observability in linear control systems N81-20355

KENTUCKY
Green River Basin flow forecasting models [PB81-124448] N81-20529

KEPLER LAWS
The solar system --- description and physics N81-20135

KEROSENE
Effect of additives on the lean detonation limit of kerosene sprays in air [AD-A095190] N81-20221

KERR MAGNETOOPTICAL EFFECT
Ultraviolet phase conjugation and its practical implication [LA-UR-80-3621] N81-20873

KINEMATICS
Basic notions in rational mechanics and applications to space mechanics N81-20109

KINETIC ENERGY
Basic notions in rational mechanics and applications to space mechanics N81-20109

KINETIC EQUATIONS
Kinetics of hydrogen absorption-desorption by metals [BNL-28584] N81-20259
New formulation of backward differenced linear multistep methods for ordinary differential equations [UCID-18825] N81-20779

KINETIC THEORY
A study of dispersion processes and climatology from the TWERL Balloon experiment N81-20022

KINETICS
Orbit perturbation: Causes and representation N81-20112

KNEE (ANATOMY)
Experimental joint immobilization in guinea pigs. Effects on the knee joint [NASA-TM-76067] N81-20696

KORTEWEG-DEVRIES EQUATION
Breaking solutions of the variable coefficient Korteweg-deVries equation --- ocean surface [AD-A095247] N81-20687

KRYPTON
Study of the ionization of C, N, O, Nr, Kr and Xe positive ions by electron impact [ORNL-TR-4702] N81-20841
Structural and thermodynamic properties of xenon, krypton, and argon adsorbed on silver(111) N81-20924

KRYPTON FLUORIDE LASERS
Ultraviolet phase conjugation and its practical implication [LA-UR-80-3621] N81-20873

KRYPTON 85
Ion implantation of krypton in sputter-deposited metal matrices --- storing krypton 85 [PNL-SA-8661] N81-20939

L

LABORATORIES
Jet Propulsion Laboratory: Outsider or insider? N81-20977

LABORATORY EQUIPMENT
Results on the performance of a broad hand focusing Cherenkov counter [COO-3072-119] N81-20410

LABYRINTH
Characteristics of vestibulosensory reactions studied by experimental caloric test [NASA-TM-76386] N81-20718

LAMINAR FLOW
Numerical solution of three-dimensional Navier-Stokes equations on an arbitrarily shaped body using a locally one-dimensional scheme N81-20023
Mathematical models for dispersion of chromatographic solute bands N81-20194
Computation of unsteady turbulent boundary layers with flow reversal and evaluation of two separate turbulence models [NASA-TM-81259] N81-20384
Utilization of an efficient numerical method for viscous flow problem solutions [AD-A095758] N81-20396

LAMINATES
Calculation of the room-temperature shapes of unsymmetric laminates [NASA-CR-163993] N81-20184
A unified theory of linear diffusion in multilayered materials N81-20381

LAND ICE
Radar investigations of the Ross Ice Shelf N81-20631

LAND MOBILE SATELLITE SERVICE
Satellite-aided mobile communications limited operational test in the trucking industry [NASA-CR-166658] N81-20337

LANDING AIDS
On the use of AIDS-data for a statistical analysis of wind shear during the approach N81-20010

LANDMARKS
Technical demonstration: Apparatus for locating landmarks --- on images N81-20523

LANGUAGE PROGRAMMING
Introduction to Praxis [UCRL-52957-REV-1] N81-20753

LAPLACE TRANSFORMATION
On the determination of boundary collocation points for solving some problems for the Laplace operator [TRITA-NA-8006] N81-20782
On the use of hierarchically computed 'Mexican Hat' features for texture discrimination [AD-A095718] N81-20792

LARGE SCALE INTEGRATION
Crystal defects in large scale integrated circuits of silicon --- and implications for crystal growth process control [BMFT-FB-T-79-156] N81-20369
Monolithic integrated semiconductor switches with low on-resistance --- for private automatic branch exchange (PABX) applications [BMFT-FB-T-80-016] N81-20373

LARGE SPACE STRUCTURES
Space platform advanced technology study [NASA-CR-160934] N81-20146
Graphite composite truss welding and cap section forming subsystems. Volume 1: Executive summary --- large space structures [NASA-CR-160933] N81-20462

LARMOR RADIUS
An experimental study of finite Larmor radius effects in a linear Z-pinch N81-20886

LASER ANEMOMETERS
Experiments using a three-component laser-anemometry system on a subsonic flow with vorticity --- in a wind tunnel [RAE-TR-80081] N81-20089
Information content of LDA-signals and operations of LDA-signal processors --- measurement of flow properties N81-20387
High speed velocity measurements using laser-Doppler anemometers --- application to turbulent fluid flows and measurement optimization N81-20388
Turbulence measurements in supersonic flows --- hot-wire versus laser anemometry N81-20392
Measurements of the transverse velocity of a separating turbulent boundary layer --- wind tunnel tests [AD-A095256] N81-20395

LASER APPLICATIONS
Laser fluorescence immunoassay N81-20206
Laser fluorescence detection for high performance liquid chromatography N81-20207
Direct narrow line tuning of a high power CO2 laser [PPPL-1736] N81-20421
Dynamic test of an arch dam using a laser light vibration sensor [CISE-1576] N81-20482

LASER DOPPLER VELOCIMETERS
Information content of LDA-signals and operations of LDA-signal processors --- measurement of flow properties N81-20387
High speed velocity measurements using laser-Doppler anemometers --- application to turbulent fluid flows and measurement optimization N81-20388
Measurements of a separating turbulent boundary layer [AD-A095252] N81-20394

LASER FUSION
Evidence for self-focusing or filamentation from X-ray, 3/2 omega 0, and 2 omega 0 emission [AD-A095450] N81-20416
Inertial fusion program [LA-7755-PR] N81-20901

LASER HEATING
Solar coal gasification [DOE/TIC-11384] N81-20587

LASER INTERFEROMETRY
Heterodyne interferometric and moire test methods for surface measurements N81-20914

LASER OUTPUTS
Ultraviolet photodissociation of molecular beams [AD-A095472] N81-20835
Statistical properties of visible and infrared beams retroreflected through a turbulent atmosphere [LA-UR-80-3674] N81-20872

LASER PLASMA INTERACTIONS
Absorption of laser radiation in a plasma with subcritical density [UCRL-TRANS-11633] N81-20905

LASER PLASMAS
Anomalous visible emission observed from the rear side of laser irradiated thin transparent targets [AD-A095563] N81-20417

LASER PUMPING
A theoretical assessment of vibrational to rotational energy exchange in the hydrogen fluoride chemical laser N81-20413
Nonequilibrium photochemical reactions induced by lasers [DOE/ET-33056/15] N81-20594

LASER SPECTROSCOPY
New techniques in atomic and molecular laser spectroscopy N81-20210
Laser spectroscopy for the environment [BMFT-FB-T-80-014] N81-20617
Laser spectroscopy: Rare-earth crystals and crystals in solution N81-20913

LASER TARGET INTERACTIONS
Characteristics of ablation plasma from planar, laser-driven targets [AD-A095667] N81-20891
Absorption of laser radiation in a plasma with subcritical density [UCRL-TRANS-11633] N81-20905

LASER TARGETS
Anomalous visible emission observed from the rear side of laser irradiated thin transparent targets [AD-A095563] N81-20417
Inertial fusion program [LA-7755-PR] N81-20901

LASERS
Nonequilibrium photochemical reactions induced by lasers
[DOE/ET-33056/15] N81-20594
LASING
Atmospheric effects on low-power laser beam propagation
[AD-A095383] N81-20418
LATITUDE
The equatorial latitude of auroral activity 1972 - 1977 --- dmsp satellite observation
[PB81-132912] N81-20654
LAUNCH VEHICLE CONFIGURATIONS
Spacecraft launching --- launch vehicle considerations N81-20123
Launch systems for the 1980's --- their evolution, and prospects for the STS and ARIANE sustems N81-20124
LAUNCH VEHICLES
The Aerospace Vehicle Interactive Design system
[NASA-TM-81957] N81-20167
Rockets and spacecraft: Sine qua non of space science N81-20972
LAUNCHING
Study of certain launching techniques using long orbiting tethers
[NASA-CR-164060] N81-20107
LEAD ALLOYS
A heat pulse study of superconducting lead/indium alloys N81-20921
Fluxoid pinning by planar defects in Pb-Bi alloy films N81-20927
LEADERSHIP
Leadership and changing times --- nasa management N81-20979
LEADING EDGE SLATS
Leading edge devices on slender wings --- wind tunnel tests of delta wings
[BU-250] N81-20041
LEADING EDGES
Leading-edge separation from a slender rolling wing-body combination --- vortex sheet model
[RAE-TR-80039] N81-20040
LEAST SQUARES METHOD
Orbit determination: Statistical methods N81-20116
LEAVES
Fundamentals of remote sensing relations between spectral signatures and physical properties of crops
[NLR-MP-79035-U] N81-20527
LENSES
Thermal lens calorimetry N81-20204
LIBRARIES
Data bases available at the National Bureau of Standards library
[PB81-132870] N81-20955
LIFE (DURABILITY)
Insert type milling cutter evaluation
[SAND-80-2185C] N81-20439
LIFE CYCLE COSTS
Concept definition: Retirement for cause of F-100 rotor components
[AD-A095584] N81-20080
A life-cycle model for solar heating system design and economic evaluation Michigan Economic Model for Solar Heating (MESH) N81-20559
LIFE SCIENCES
Life sciences: No place in the Sun --- NASA management N81-20978
LIFE SUPPORT SYSTEMS
Lightside atmospheric revitalization system
[NASA-CR-160897] N81-20731
LIFT DEVICES
A study of high-altitude manned research aircraft employing strut-braced wings of high-aspect-ratio
[NASA-CR-159262] N81-20067
LIGHT (VISIBLE RADIATION)
Lidar observations at 0.7 micrometers and 10.6 micrometers wavelengths during Smoke Week 2
[AD-A095356] N81-20341
LIGHT AIRCRAFT
flight data recording and data processing for light airplanes and gliders N81-20008
LIGHT ALLOYS
Structure and properties of light alloys
[TT-76-52003] N81-20263
LIGHT AMPLIFIERS
Optical gain in semiconductor lasers
[BMFT-FB-T-79-167] N81-20422
LIGHT BEAMS
Statistical properties of visible and infrared beams retroreflected through a turbulent atmosphere
[LA-UR-80-3674] N81-20872
LIGHT EMITTING DIODES
Materials for opto-electronic devices --- fabrication of doped GaAs and GaP materials
[BMFT-FB-T-80-026] N81-20940
LIGHT MODULATION
Integrated thin-film light modulation lines and matrices
[BMFT-FB-T-80-013] N81-20877
LIGHT TRANSMISSION
Atmospheric effects on low-power laser beam propagation
[AD-A095383] N81-20418
LIGHTNING
Airborne lightning warning systems: A survey
[AD-A095354] N81-20045
Evaluation of the behavior of structures made of high modulus composite materials when struck by lightning
[NASA-TM-75866] N81-20188
Thundercloud local electric field intensification during the pre-breakdown phase of lightning --- time and space evolution N81-20657
The 1980 direct strike lightning data
[NASA-TM-81946] N81-20668
LIGNIN
Liquefaction of biomass
[LBL-PUB-350] N81-20576
LIMBS (ANATOMY)
Morphological changes in neurons of the hind limb reflex arc during long term immobilization
[NASA-TM-75939] N81-20695
LINE CURRENT
An experimental study of finite Larmor radius effects in a linear Z-pinch N81-20886
LINEAR ACCELERATORS
Concepts and limitations of macroparticle accelerators using traveling magnetic waves
[LA-UR-80-3507] N81-20860
LINEAR ARRAYS
Waveguide model N81-20332
LINEAR EQUATIONS
Parallel solution of large sparse linear equations using a processor network N81-20754
Function space variable metric methods with applications to singular optimal control computation N81-20759
Solution of homogeneous systems of linear equations arising from compartmental models
[ORNL/CSD-70] N81-20778
LINEAR PROGRAMMING
Efficient algorithms for certain satisfiability and linear programming problems
[AD-A095411] N81-20744
The minimax finite-element method N81-20771
LINEAR SYSTEMS
Determination of the degree of observability in linear control systems N81-20355
LINEARIZATION
A linearization technique for the dynamic response of nonlinear continuae N81-20456
LIQUEFACTION
Stoichiometry of wood liquefaction
[LBL-11776] N81-20298
Liquefaction of biomass
[LBL-PUB-350] N81-20576
LIQUID CHROMATOGRAPHY
Laser fluorescence detection for high performance liquid chromatography N81-20207
Analysis of RDX and HMX in PBX 9404 by high performance liquid chromatography
[MHSMP-80-55] N81-20307
LIQUID CRYSTALS
Flat display panel in liquid crystal technology
[BMFT-FB-T-80-012] N81-20876
Nonlinear optical effects in liquid crystals --- second-harmonic generations
[AD-A095368] N81-20934
LIQUID HELIUM
Attenuation of zero sound in liquid He(3)-A N81-20930
LIQUID HELIUM 2
An investigation of Tkachenko waves in rotating He2 N81-20916
LIQUID HYDROGEN
Development and validation of cryogenic foam insulation for LH2 subsonic transports
[NASA-CR-3404] N81-20312
LIQUID LITHIUM
Kinetics of the degradation of type 316 stainless steel by liquid lithium N81-20239
LIQUID ROCKET PROPELLANTS
Natural nutation damping due to the ergols of the hot gaz propulsion system. Synthesis of MV1 and MV2 in-flight results
[CNES-79/CT/PRT/SST/SS/166] N81-20170
LIQUID-SOLID INTERFACES
Corrosion control through a better understanding of the metallic substrate/organic coating/interface
[AD-A095420] N81-20252
Coupled fluid structure interaction problems, the case of an elastic-plastic shell and an acoustic fluid N81-20379
Ultrasonic imaging with narrow beam insonification across a fluid-metal interface N81-20827
LIQUIDS
Ignition of a liquid fuel under high intensity radiation
[AD-A095691] N81-20223
An experimental device for measurement of the viscoelastic properties of thickened liquids
[AD-A095396] N81-20225
LISTS
Data bases available at the National Bureau of Standards library
[PB81-132870] N81-20955
LITHIUM ALLOYS
Reaction rates of atmospheric gases with Lithium (Silicon) alloy
[SAND-80-1363] N81-20234
LITHIUM SULFUR BATTERIES
Analysis of the Lithium Sulfur Dioxide System at ultra-high rate discharges --- electrolytic cells
[AD-A095549] N81-20365
LITHOSPHERE
Reflection and transmission of obliquely incident Rayleigh waves at a vertical discontinuity N81-20629
Research of the state of convection in the Earth's mantle
[NASA-CR-163989] N81-20639
LIVER
Activity of certain enzymes in subcellular fractions of rat liver after flight on Cosmos 1129 biosatellite
[NASA-TM-76472] N81-20701
LOAD TESTS
Transfer film evaluation for shuttle engine turbopump bearing
[NASA-CR-161672] N81-20425
Category 1 structures: Safety margin at ultimate load
[LA-UR-80-2858] N81-20472
LOADING MOMENTS
Dynamic stability of structural elements subjected to step loads N81-20459
LOADS (FORCES)
Stress analysis of aircraft modifications (C-141B Aircraft). Joint Airborne Communications Center/Command Post (JACC/CP) provisions
[AD-A095634] N81-20072
Critically loaded hole technology pilot collaborative test programme
[AGARD-R-678] N81-20461
LOGIC CIRCUITS
Combination of integrated injection logic (IIL) for UHF analog circuitry
[BMFT-FB-T-80-010] N81-20371
LOGICAL ELEMENTS
Control of database access and integrity in cellular-logic devices N81-20735
LOGISTICS
Testing aircraft instruments
[AD-A095880] N81-20075
LONG RANGE WEATHER FORECASTING
Stepwise linear regression experiments in 14 and 19 day hemispheric weather prediction
[INPE-1948-RPE/265] N81-20662
LORAN C
Loran-C plotting program for plotting lines of position on standard charts
[NASA-CR-164082] N81-20052
Automatic gain control --- the Loran-C receiver
[NASA-CR-164082] N81-20053

LOW COST
Proceedings of the 16th Project Integration Meeting
[NASA-CR-164073] N81-20545
LOW PRESSURE
Flow in a 320 MW low-pressure section: Theoretical and experimental evaluation --- of the steam fluid dynamic behavior and turbine performance N81-20432
LOW TEMPERATURE
A search for the origin of low temperature anomalies in glasses N81-20922
LOWER BODY NEGATIVE PRESSURE
Specialized physiological studies in support of manned space flight
[NASA-CR-160936] N81-20707
Tolerance of Lower Body Negative Pressure (LBNP) in endurance runners, weightlifters, swimmers and nonathletes N81-20708
Instantaneous stroke volume by PDE during and after constant LBNP (-50 torr) N81-20711
Changes in cardiac output and tibial artery flow during and after progressive LBNP N81-20712
LUBRICATION
Dynamics of solid dispersions in oil during the lubrication of point of contacts. Part 2: Molybdenum disulfide
[NASA-TM-81709] N81-20275
Dry lubrication of high temperature silicon nitride rolling contacts
[AD-A095202] N81-20435
LUMINOUS INTENSITY
The optical contrast of land and sea targets N81-20804
LYRAE CONSTELLATION
The chemical abundances and physical parameters of RR Lyrae stars N81-20985

M

M STARS
Studies of stellar populations: Star clusters in M31, the galaxy and the Magellanic Clouds N81-20986
MACH NUMBER
Operating characteristics of the Langley Mach 7 Scramjet Test Facility
[NASA-TM-81929] N81-20083
About the parametric interplay between ionic Mach number, body-size and satellite potential in determining the ion depletion in the wake of the S3-2 satellite
[AD-A095507] N81-20149
MAGELLANIC CLOUDS
Studies of stellar populations: Star clusters in M31, the galaxy and the Magellanic Clouds N81-20986
Discovery of water vapor maser in the large Magellanic cloud
[INPE-1959-RPE/273] N81-20995
On the origin of the March 5, 1979 gamma ray transient: A vibrating neutron star in the Large Magellanic Cloud
[NASA-TM-80738] N81-21006
MAGMA
Comparative assessment of five potential sites for hydrothermal-magma systems: Summary
[DOE/TIC-11303] N81-20525
MAGNESIUM ALLOYS
Studies of hydrogen embrittlement and stress-corrosion cracking in an aluminum-zinc-magnesium alloy
[DOE/ER-01198/1325] N81-20256
MAGNET COILS
Mirror fusion test facility magnet system
[UCRL-52955] N81-20904
MAGNETIC ANOMALIES
Geophysical investigations of the southern continental margin of Australia and the conjugate sector of East Antarctica N81-20632
Brazilian magnetic anomaly
[INPE-1935-RPE/258] N81-20636
MAGNETIC COILS
Application of superconducting coils to the NASA prototype magnetic balance
[NASA-CR-165660] N81-20086
MAGNETIC EQUATOR
Longitudinal differences in the spread F characteristics in the American zone and implications on the F-region dynamo
[INPE-1941-RPE/260] N81-20635
The equatorial latitude of auroral activity 1972 - 1977 --- dmsp satellite observation
[PB81-132912] N81-20654
MAGNETIC FIELD CONFIGURATIONS
Auroral Electrojet magnetic activity indices AE(12) for July-December 1975
[PB81-125551] N81-20653
MAGNETIC FIELDS
'Finite part' electric and magnetic stored energies for planar antennas
[NASA-TM-81955] N81-20336
Concepts and limitations of macroparticle accelerators using traveling magnetic waves
[LA-UR-80-3507] N81-20860
Energization of electrons in a plasma beam entering a curved magnetic field
[TRITA-EPP-80-09] N81-20909
MAGNETIC FLUX
Analysis and simulation of a magnetic bearing suspension system for a laboratory model annular momentum control device
[NASA-TP-1799] N81-20311
Axial shock wave heating of reversed-field theta-pinch plasmas
[MSNW-81-1158-1] N81-20908
Fine-scale characteristics of interplanetary sector
[NASA-TM-82281] N81-20997
MAGNETIC MIRRORS
Commerical tandem mirror reactor design with thermal barriers: WITAMIR-I
[UWFDM-375] N81-20887
Symmetric tandem mirror program
[DOE/ET-51017/T1] N81-20894
Orbit averaged radial buildup code for tandem mirror geometry
[UCID-18905] N81-20907
MAGNETIC SIGNATURES
Synoptic solar magnetic field maps for the interval including Carrington Rotation 1601-1680, May 5, 1973 - April 26, 1979
[PB81-125569] N81-21003
MAGNETIC STORMS
A theoretical and experimental study on the atomic oxygen corona in the Earth's atmosphere N81-20624
Magnetospheric sounding rocket program: The magnetometer experiment in the substorm phenomena payload
[BMFT-FB-W-79-34] N81-20649
MAGNETIC SUSPENSION
Application of superconducting coils to the NASA prototype magnetic balance
[NASA-CR-165660] N81-20086
Coal preparation using magnetic separation. Volume 5: Evaluation of magnetic coal desulfurization concepts
[EPRI-CS-1517-VOL-5] N81-20302
Analysis and simulation of a magnetic bearing suspension system for a laboratory model annular momentum control device
[NASA-TP-1799] N81-20311
MAGNETOHYDRODYNAMIC GENERATORS
MHD air heater development technology
[DOE/ET-15602/T2] N81-20590
MAGNETOHYDRODYNAMIC STABILITY
Energy principle with global invariants --- equilibria in toroidal plasmas N81-20879
Drift-cyclotron loss-cone instability in the presence of the external wave fields N81-20885
An experimental study of finite Larmor radius effects in a linear Z-pinch N81-20886
Ideal MHD equilibrium of a weakly toroidal plasma column with elongated cross section. Part 2: Force-free fields
[REPT-80-124-PT-2] N81-20911
MAGNETOHYDRODYNAMICS
Alternating-direction implicit numerical solution of the time dependent, three-dimensional, SingIt fluid, resistive magnetohydrodynamic equations
[UCRL-53086] N81-20780
Simulation studies of the stability of weak and strong ion layers and rings N81-20882
MAGNETOMETERS
Magnetospheric sounding rocket program: The magnetometer experiment in the substorm phenomena payload
[BMFT-FB-W-79-34] N81-20649
MAGNETOPAUSE
Evidence for magnetic field reconnection at the Earth's magnetopause
[NASA-CR-164066] N81-20637
Structure of the low latitude boundary layer
[NASA-CR-164056] N81-20638
Solar wind energy and electric field transfer to the Earth's magnetosphere via magnetopause reconnection
[INPE-1940-RPE/259] N81-21001
MAGNETOPLASMADYNAMICS
Evidence for magnetic field reconnection at the Earth's magnetopause
[NASA-CR-164066] N81-20637
MAGNETOSPHERE
Electric fields in the magnetosphere --- plasma-electromagnetic interactions
[TRITA-EPP-80-06] N81-20651
On the complex state of the interplanetary medium of 28-29 July 1977
[NASA-TM-82095] N81-20996
MAGNETS
Microstructure and properties of step aged rare Earth alloy magnets
[LBL-11680] N81-20938
MAGNUS EFFECT
Further studies on magnus phenomena on spinning and coning bodies
[AD-A095193] N81-20032
MAINTAINABILITY
The F/A-18 Naval Strike Fighter: Progress has been made but problems and concerns continue
[AD-A095287] N81-20069
MAINTENANCE
Scarf joints in unidirectional carbon fiber reinforced plastics --- tests of repairs made using adhesives
[BU-258] N81-20193
Improved emission spectrographic facility
[DPSPU-80-30-7] N81-20228
On the optimal maintenance of reliability systems N81-20445
The effects of repair patches on the stress distribution in a cracked sheet --- models of rectangular and square patches
[RAE-TR-80098] N81-20480
MAN MACHINE SYSTEMS
On the optimal maintenance of reliability systems N81-20445
Teamwork in target Acquisition N81-20808
Assistance in interpreting satellite multispectral imagery N81-20811
MANAGEMENT
NASA gets under way N81-20970
MANAGEMENT PLANNING
National Transonic Facility: A review of the operational plan
[PB81-115289] N81-20090
The development of synthetic fuels: Department of Defense logistics implications
[AD-A095713] N81-20290
MANEUVERABILITY
A computer technique for detailed analysis of mission radius and maneuverability characteristics of fighter aircraft
[NASA-TP-1837] N81-20026
MANGANESE ALLOYS
Mechanism of work hardening in Hadfield manganese steel N81-20243
MANNED SPACECRAFT
Rockets and spacecraft: Sine qua non of space science N81-20972
MANUALS
A pilot training manual for the terminal configured vehicle electronic horizontal situation indicator
[NASA-TM-81959] N81-20044
MANUFACTURING
Insert type milling cutter evaluation
[SAND-80-2185C] N81-20439
MANY BODY PROBLEM
Self-consistent many body theory for the standard basis operator Green's functions
[INPE-1982-RPE/275] N81-20942
MAPPING
Cartography --- generalities on the compilation of maps N81-20498
Applied research in analytical photogrammetry
[PB81-127300] N81-20530

MARGINS
Geophysical investigations of the southern continental margin of Australia and the conjugate sector of East Antarctica N81-20632
MARINE ENVIRONMENTS
A continuous corrosivity monitoring device for naval environments
[AD-A095728] N81-20250
Marine biomass: Algae as source of energy
[NE/BIO-80/12] N81-20581
MARKET RESEARCH
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 3, appendix B: State of the art, trends, and potential growth of selected DSG technologies
[NASA-CR-164054] N81-20540
MARS ATMOSPHERE
A simple static photochemical transport model for application to the upper atmospheres of Earth, Mars and Venus
[BMFT-FB-W-79-35] N81-20650
MARS SURFACE
Analogs of Martian eolian features in southwestern Egypt N81-20640
The composition of the Martian dark regions: Observations and analysis
[NASA-CR-164072] N81-20999
MASERS
Discovery of water vapor maser in the large Magellanic cloud
[INPE-1959-RPE/273] N81-20995
MASS
The solar system --- description and physics N81-20135
Hydrodynamic pressure and added mass for axisymmetric bodies --- finite element method
[PB81-122343] N81-20404
MASS SPECTROMETERS
The high resolution imaging atom-probe with application to nickel platings
[AD-A095254] N81-20251
MASS SPECTROSCOPY
Studies in chemical ionization mass spectrometry N81-20208
MASS TRANSFER
Subsonic axisymmetric base flow control using boundary layer thickness and near-wake mass balance variations N81-20024
Determination of the effect of composition structure and electrochemical mass transport properties on adhesion and corrosion inhibition of paint films
[AD-A095293] N81-20278
MATCHING
The traveling salesman (0,2) matchings
[AD-A095716] N81-20775
MATERIALS HANDLING
Radiation effects in crystalline high-level nuclear waste solids
[PNL-SA-8732] N81-20858
MATERIALS RECOVERY
Recovery and use of fission product noble metals
[PNL-SA-8358] N81-20258
Analysis of RDX and HMX in PBX 9404 by high performance liquid chromatography
[MHSMP-80-55] N81-20307
MATHEMATICAL LOGIC
Applications of logic to finite combinatorics N81-20767
The complexity of provable properties of first order theories
[AD-A095656] N81-20773
MATHEMATICAL MODELS
Further studies on magnus phenomena on spinning and coning bodies
[AD-A095193] N81-20032
Leading-edge separation from a slender rolling wing-body combination --- vortex sheet model
[RAE-TR-80039] N81-20040
Optimum maneuvers of supersonic aircraft, volumes 1 and 2 N81-20060
Extended frequency turbofan model
[NASA-CR-165261] N81-20078
Orbit perturbation: Causes and representation N81-20112
Generalities and definition of a system --- for command and control of satellite attitude and orbit N81-20118
Mathematical models for dispersion of chromatographic solute bands N81-20194
The influence of turbulence on combustion in open pre-mixed flames N81-20198
Melt purification via filtration
[AD-A095414] N81-20253
Interaction between computational modelling and experiments for vacuum consumable arc remelting
[SAND-80-1177C] N81-20257
Turbulence transport models for numerical computation of complex turbulent flows N81-20386
The aerospace thermal model (HFLUX): Its structure and utility
[AD-A095359] N81-20397
Application of the line-spring model to a cylindrical shell containing a circumferential or axial part-through crack N81-20464
The effects of repair patches on the stress distribution in a cracked sheet --- models of rectangular and square patches
[RAE-TR-80098] N81-20480
Orthophotography and numerical terrain models --- of aerial imagery N81-20506
The geometry of scanning imagery N81-20509
Models of deformation --- introduced by the transformation of terrain coordinates into image coordinates N81-20515
Green River Basin flow forecasting models
[PB81-124448] N81-20529
Cost/performance of solar reflective surfaces for parabolic dish concentrators
[NASA-CR-164088] N81-20547
A life-cycle model for solar heating system design and economic evaluation Michigan Economic Model for Solar Heating (MESH) N81-20559
Description, evaluation, and sensitivity analyses analyses of principal US EPA air quality prediction models
[ANL/EES-TM-111] N81-20611
Resolving the heat-flow anomaly at the Galapagos Spreading Center N81-20625
Body and surface wave modeling of observed seismic events
[AD-A095690] N81-20645
A mathematical model for how ionospheric reflection degrades sea-echo spectra
[PB81-108359] N81-20652
Comparison of observed and predicted slope winds
[PNL-SA-8785] N81-20679
Current-wave spectra coupling project, volume 4. Part A: Formulation of the three-dimensional structure of storm-generated currents. Part B: Summaries of volumes 1, 2 and 3 --- hurricane conditions at potential otec sites
[DOE/SF-20235/T1-VOL-4] N81-20689
Solution of homogeneous systems of linear equations arising from compartmental models
[ORNL/CSD-70] N81-20778
An approach to airborne infrared search set performance modeling N81-20805
Numerical target tracking N81-20817
Quark and gluon decay functions in QCD and recombination model
[DOE/ER-70004/266] N81-20845
Radioactive waste storage in mined caverns in crystalline rock: Results of field investigations at Stripa, Sweden
[LBL-11651] N81-20857
Orbit averaged radial buildup code for tandem mirror geometry
[UCID-18905] N81-20907
Axial shock wave heating of reversed-field theta-pinch plasmas
[MSNW-81-1158-1] N81-20908
Consistency of the standard model of primordial nucleosynthesis: Response to the comment of Olive and Turner
[NASA-TM-82082] N81-20994
MATRICES (CIRCUITS)
Flat display panel in liquid crystal technology
[BMFT-FB-T-80-012] N81-20876
Integrated thin-film light modulation lines and matrices
[BMFT-FB-T-80-013] N81-20877
MATRICES (MATHEMATICS)
Solution of homogeneous systems of linear equations arising from compartmental models
[ORNL/CSD-70] N81-20778
Infinite frequency interpretations of minimal bases --- factorizations of rational matrices
[MATH-RES-148] N81-20783
Some problems in combinatorial matrix theory N81-20798
MATRIX MATERIALS
Photoelastic studies of internal stress distributions of unidirectional composites
[AD-A095595] N81-20190
Quantitative ion microscopy by digital image processing N81-20205
The generalized standard addition method: Intermetallic interferences in anodic stripping voltammetry
[AD-A095419] N81-20222
Microscopic processes in the ductile fracture of precipitation hardened A1-1.79 W/O Cu alloys N81-20240
MATRIX THEORY
Some problems in combinatorial matrix theory N81-20798
MATTER (PHYSICS)
Fundamental understanding of matter: An engineering viewpoint
[LA-UR-80-3585] N81-20181
MAXIMUM ENTROPY METHOD
Image processing
[AD-A095552] N81-20764
MAXIMUM LIKELIHOOD ESTIMATES
International seismological data center: Procedures to check events through dynamic information and to estimate magnitudes --- monitoring for the nuclear test ban treaty
[FOA-C-20368-T1] N81-20648
MAXIMUM USABLE FREQUENCY
An investigation of high frequency propagation over an auroral sub-auroral path --- prediction of usable frequencies
[RAE-TM-RAD-NAV-138] N81-20350
MAXWELL EQUATION
Plane wave derivation N81-20330
MEAN SQUARE VALUES
A response spectrum method for random vibrations
[PB81-122301] N81-20483
MEASURING INSTRUMENTS
Diagnostic system design for the Ion Auxiliary Propulsion System (IAPS). Flight tests of two 8 cm mercury ion
[NASA-TM-81702] N81-20172
MECHANICAL DEVICES
Sputtering and ion plating for aerospace applications
[NASA-TM-81726] N81-20424
MECHANICAL DRIVES
Life analysis of multiroller planetary traction drive
[NASA-TP-1710] N81-20423
MECHANICAL ENGINEERING
Space platform advanced technology study
[NASA-CR-160934] N81-20146
MECHANICAL PROPERTIES
Stress analysis of aircraft modifications (C-141B Aircraft). Joint Airborne Communications Center/Command Post (JACC/CP) provisions
[AD-A095634] N81-20072
Evaluation of the behavior of structures made of high modulus composite materials when struck by lightning
[NASA-TM-75866] N81-20188
Flexure tests of three fibrous composite materials
[FFA-TN-HU-2127-PT-3] N81-20192
Scarf joints in unidirectional carbon fiber reinforced plastics --- tests of repairs made using adhesives
[BU-258] N81-20193
Structure and properties of light alloys
[TT-76-52003] N81-20263
Engineering properties of the recently developed aluminum alloy designated 7010 --- thick plates
[NLR-TR-79017-U] N81-20269
Engineering property comparisons for four AlZnMgCu type forging alloys
[NLR-TR-79022-U] N81-20270
Galvanizing
[PB81-120271] N81-20271
MELTING
Melt purification via filtration
[AD-A095414] N81-20253
MELTING POINTS
Investigations on processing and properties of high-temperature silicon carbide materials
[BMFT-FB-T-79-170] N81-20282

MEMBRANES
Technical and economic feasibility of membrane technology
[DOE/CS-40213/T1] N81-20231
MERCURY (METAL)
Extended operating range of the 30-cm ion thruster with simplified power processor requirements
[NASA-TM-81729] N81-20179
Passivation of carbon steel through mercury implantation
[NASA-CR-165292] N81-20244
MERCURY CADMIUM TELLURIDES
Advanced methods for preparation and characterization of infrared detector materials --- mercury cadmium tellurides
[NASA-CR-161598] N81-20863
MERCURY ION ENGINES
Diagnostic system design for the Ion Auxiliary Propulsion System (IAPS). Flight tests of two 8 cm mercury ion
[NASA-TM-81702] N81-20172
Retrofit and verification test of a 30-cm ion thruster
[NASA-CR-165233] N81-20174
MESSAGE PROCESSING
Bounds on transmission delays for the CCRA --- Capetanakis collision resolution protocol
[AD-A095658] N81-20346
METAL COATINGS
Adhesion and chemical vapor testing of second surface silver/glass solar mirrors
[PNL-3575] N81-20577
METAL CUTTING
Insert type milling cutter evaluation
[SAND-80-2185C] N81-20439
METAL FILMS
Fluxoid pinning by planar defects in Pb-Bi alloy films N81-20927
The application of nuclear techniques to solid state devices
[AD-A095251] N81-20933
METAL IONS
Detection of metal ions by glass capillary gas chromatographic separation of their volatile chelates N81-20212
METAL JOINTS
Evaluation of the wedge cleavage test for assessment of durability of adhesive bonded joints --- epoxy resin
[RAE-TM-MAT-349] N81-20479
METAL OXIDE SEMICONDUCTORS
Materials and methods for the development of solar energy --- thin film cells
[BMFT-FB-T-80-065] N81-20601
Advanced Query Facility
[AD-A095717] N81-20950
METAL OXIDES
Superstructure phonons and their characterization by Raman Spectroscopy --- zincblende and metal oxides N81-20929
METAL PLATES
Engineering properties of the recently developed aluminum alloy designated 7010 --- thick plates
[NLR-TR-79017-U] N81-20269
Quantitative schlieren analysis of acoustic interaction with submerged plates N81-20828
METAL SHEETS
Computer Evaluation of Surface Topography (CEST) and applications to sheet steel finishing processes N81-20237
Damage tolerance of hybrid structures --- crack propagation in aluminum alloy sheet reinforced by four unidirectional fiber/epoxy strips
[BMVG-FBWT-79-27] N81-20477
The effects of repair patches on the stress distribution in a cracked sheet --- models of rectangular and square patches
[RAE-TR-80098] N81-20480
METAL SURFACES
Corrosion control through a better understanding of the metallic substrate/organic coating/interface
[AD-A095420] N81-20252
Ultrasonic imaging with narrow beam insonification across a fluid-metal interface N81-20827
Ion implantation of krypton in sputter-deposited metal matrices --- storing krypton 85
[PNL-SA-8661] N81-20939
METAL WORKING
Upper-bound solutions to flow through conical converging dies --- metal forming
[DOE/ER-10367/T3] N81-20400
METAL-METAL BONDING
Reactions of metal-metal multiple bonds. 8: Forming Mo-Mo quadruple bonds by reductive elimination (alkyl group disproportionation) in the reactions of 1,2-Mo2R2(NMe)4 compounds (M triple bond M) with carbon dioxide and 1,3-Diaryltriazenes
[AD-A095421] N81-20224
METALLIC STARS
The chemical abundances and physical parameters of RR Lyrae stars N81-20985
Studies of stellar populations: Star clusters in M31, the galaxy and the Magellanic Clouds N81-20986
METALLOGRAPHY
The deformation of grains during cold-rolling N81-20238
METASTABLE ATOMS
Metal-metastable energy transfer for atomic luminescence N81-20203
METEOROLOGICAL FLIGHT
Prophets and pioneers of spaceflight N81-20965
METEOROLOGICAL INSTRUMENTS
In-flight calibration of the NOAA/RFC meteorological research aircraft instruments at the Air Force Eastern Test Range, 1977 - 1978
[PB81-132771] N81-20682
METEOROLOGICAL PARAMETERS
October 1980 environmental data for sites in the National Solar Data Network
[SOLAR/0010-80/10] N81-20588
Summary of Jimsphere wind profiles: Programs, data, comments, part 1 --- for use in aeronautical vehicle design and engineering
[NASA-CR-161664] N81-20667
Revised Uniform Summary of Surface Weather Observations (RUSSWO), Lajes Fld, Terceira, Azores, parts A-F
[AD-A095330] N81-20671
Hickam AFB, Honolulu, Hawaii, revised uniform summary of Surface Weather Observations (RUSSWO), parts A-F
[AD-A095331] N81-20673
Revised Uniform Summary of Surface Weather Observations (RUSSWO), Maui Optical Site, Mount Halekulia, Hawaii, parts C, E-F
[AD-A095328] N81-20674
METEOROLOGICAL RADAR
Minimum operational performance standards for airborne weather and ground mapping pulsed radars
[RTCA/DO-173] N81-20323
METEOROLOGICAL SOLENOIDS
Upper tropospheric cyclonic vortices in the tropical South Atlantic
[INPE-1946-RPE/263] N81-20660
METEOROLOGY
Davison AAF, Ft. Belvoir Virginia, Revised Uniform Summary of Surface Weather Observations (RUSSWO), parts A-F
[AD-A095332] N81-20672
Portland IAP, Portland, Oregon, Revised Uniform Summary of Surface Weather Observations (RUSSWO), parts A-F
[AD-A095329] N81-20675
METHANATION
Alloy catalysts with monolith supports for methanation of coal-derived gases
[FE-2729-11] N81-20232
METHANE
Marine biomass: Algae as source of energy
[NE/BIO-80/12] N81-20581
Response of selected microorganisms to experimental planetary environments
[NASA-CR-164064] N81-20733
MICROANALYSIS
The development and evaluation of an automated reflectance microscope system for the petrographic characterization of bituminous coals N81-20488
MICROBIOLOGY
Response of selected microorganisms to experimental planetary environments
[NASA-CR-164064] N81-20733
MICROCOMPUTERS
Applications of microcomputers to spectroscopy and electrochemistry N81-20209
MICROCRACKS
Microscopic processes in the ductile fracture of precipitation hardened A1-1.79 W/O Cu alloys N81-20240
MICROELECTRONICS
Microelectronics availability for the Army's missiles
[AD-A095379] N81-20152
MICROORGANISMS
Response of selected microorganisms to experimental planetary environments
[NASA-CR-164064] N81-20733
MICROPROCESSORS
Automated intelligibility measurement system
[AD-A095664] N81-20739
A flexible image processing system N81-20810
MICROSTRUCTURE
Deformation microstructure developed during fatigue crack propagation in type 316 stainless steel at 593 deg C
[AD-A095387] N81-20246
The microstructural and property changes of laser treated electrodeposits
[AD-A095345] N81-20254
Metallurgical characterization of superplastic forming
[AD-A095720] N81-20255
Structure and properties of light alloys
[TT-76-52003] N81-20263
Microstructure and properties of A15 superconductors formed by direct precipitation
[LBL-11605] N81-20367
Investigation of solar cells based on Cu20
[DOE/ET-23006/4] N81-20593
Microstructure and properties of step aged rare Earth alloy magnets
[LBL-11680] N81-20938
MICROWAVE CIRCUITS
Tantalum aluminum thin film technology for a new generation of microwave integrated circuit applications --- selective etching process control
[BMFT-FB-T-80-015] N81-20372
MICROWAVE FREQUENCIES
A theoretical study of microwave beam absorption by a rectenna
[NASA-CR-160921] N81-20328
MICROWAVE IMAGERY
Snow water equivalent determination by microwave radiometry
[NASA-TM-82074] N81-20490
MICROWAVE LANDING SYSTEMS
Operational considerations in utilization of microwave landing system approach and landing guidance
[NASA-TM-81945] N81-20050
Flight tests of the microwave landing system multimode digital processor
[AD-A095449] N81-20056
MICROWAVE TUBES
Three-axis electron-beam test facility
[NASA-TP-1836] N81-20359
MICROWAVES
A theoretical study of microwave beam absorption by a rectenna, introduction --- solar power satellites N81-20329
MIDCOURSE GUIDANCE
Interplanetary orbit control N81-20137
MILITARY AIR FACILITIES
Hickam AFB, Honolulu, Hawaii, revised uniform summary of Surface Weather Observations (RUSSWO), parts A-F
[AD-A095331] N81-20673
Fog characteristics at Otis AFB, Massachusetts
[AD-A095358] N81-20676
MILITARY OPERATIONS
Proceedings of the ADA Debut
[AD-A095569] N81-20751
MILITARY SPACECRAFT
About the parametric interplay between ionic Mach number, body-size and satellite potential in determining the ion depletion in the wake of the S3-2 satellite
[AD-A095507] N81-20149
MILITARY TECHNOLOGY
Defense Technical Information Center referral data bank directory, Edition No. 8
[AD-A095600] N81-20952
MILLIMETER WAVES
MM-wave and X-ray observastions of a Cen-A flare
[INPE-1958-RPE/272] N81-21005

MILLING (MACHINING)
Insert type milling cutter evaluation
[SAND-80-2185C] N81-20439
Evaluation of nondestructive inspection methods applied to milled step-down areas. Volume 1: Text and tables --- in aluminum alloys
[NLR-TR-78110-U-VOL-1] N81-20450
Evaluation of nondestructive inspection methods applied to milled step-down areas. Volume 2: Figures --- in aluminum alloys
[NLR-TR-78110-U-VOL-2] N81-20451

MINERAL DEPOSITS
The petrology and geochemistry of the Baltimore Mafic Complex, Maryland N81-20627
Geology and geochronology of the Halloran Hills, southeastern California, and implications concerning mesozoic tectonics of the southwestern Cordillera N81-20628

MINERALS
Infrared spectra of some sulfides and their analogs of binary composition in the long-wave region
[NASA-TM-75901] N81-20217

MINES (EXCAVATIONS)
Critical parameters for coarse coal underground slurry haulage systems
[JPL-PUB-81-11] N81-20495
Radioactive waste storage in mined caverns in crystalline rock: Results of field investigations at Stripa, Sweden
[LBL-11651] N81-20857

MINIMAX TECHNIQUE
The minimax finite-element method N81-20771

MINIMUM VARIANCE ORBIT DETERMINATION
Orbit determination: Statistical methods N81-20116

MINNESOTA
A trophic classification of Minnesota lakes based on lake sediments
[PB81-124141] N81-20535

MIRROR FUSION
Commerical tandem mirror reactor design with thermal barriers: WITAMIR-I
[UWFDM-375] N81-20887
Mirror fusion test facility magnet system
[UCRL-52955] N81-20904

MIRRORS
Alternate protection concepts for second surface silver/glass solar mirrors
[PNL-3629] N81-20578
GIRL: German Infrared Laboratory. Telescope study, phase B
[NASA-TM-75911] N81-20866

MISMATCH (ELECTRICAL)
The correction for spectral mismatch effects on the calibration of a solar cell when using a solar simulator
[NASA-CR-164074] N81-20546

MISSILE COMPONENTS
Microelectronics availability for the Army's missiles
[AD-A095379] N81-20152

MISSILE CONFIGURATIONS
The influence of roll orientation-dependent aerodynamics on the stability of cruciform missile configurations
[AD-A095269] N81-20151

MISSILE DETECTION
Autonomous acquisition simulator and associated data
[AD-A095709] N81-20145

MISSILE RANGES
Summary of Jimsphere wind profiles: Programs, data, comments, part 1 --- for use in aeronautical vehicle design and engineering
[NASA-CR-161664] N81-20667

MISSION PLANNING
A computer technique for detailed analysis of mission radius and maneuverability characteristics of fighter aircraft
[NASA-TP-1837] N81-20026
Orbit calculation programs --- choice of hardware and implementation in function of mission requirements N81-20117
Using the ARIANE launch vehicle N81-20125
Space Shuttle Program. Mission operation report. Orbital Flight Test reference document
[NASA-TM-82321] N81-20164

MISSOURI
Modified factor analysis of selected RAPS (Regional Air Pollution Study) aerosol data --- St. Louis, Missouri area
[PB81-120784] N81-20622

MIXING
Mixing, convection, and advection in the upper ocean N81-20684

MODULATION TRANSFER FUNCTION
Research into methods of image processing for target enhancement and detection N81-20812

MOIRE EFFECTS
Time-average optical methods for strain analysis N81-20453
Heterodyne interferometric and moire test methods for surface measurements N81-20914

MOISTURE CONTENT
Snow water equivalent determination by microwave radiometry
[NASA-TM-82074] N81-20490
Fundamentals of remote sensing relations between spectral signatures and physical properties of crops
[NLR-MP-79035-U] N81-20527
Coastal remote sensing investigations. Volume 2: Beach environment
[AD-A095692] N81-20688

MOLDING MATERIALS
Molding of polypropylene film armor for radar antenna hardening applications
[AD-A095726] N81-20342

MOLDS
Casting procedure for barium metal cones used in high-altitude experiments --- reusable graphite molds
[LA-8517-MS] N81-20260

MOLECULAR BEAM EPITAXY
Growth, characterization, and applications of gallium arsenide and germanium layers grown by molecular beam epitaxy N81-20928

MOLECULAR BEAMS
Ultraviolet photodissociation of molecular beams
[AD-A095472] N81-20835

MOLECULAR COLLISIONS
Nonequilibrium photochemical reactions induced by lasers
[DOE/ET-33056/15] N81-20594

MOLECULAR EXCITATION
Studies of free radicals by ultraviolet excimer laser photolysis
[DOE/ER-10396/2] N81-20419
Atomic collision theory
[AD-A095284] N81-20838
A search for the origin of low temperature anomalies in glasses N81-20922

MOLECULAR WEIGHT
The effect of oxygen and anthraquinone on the alkaline depolymerization of amylose N81-20272

MOLECULES
The motion of macromolecules and immiscible drops in creeping flow N81-20274

MOLTEN SALTS
Molten salt coal gasification process development unit, phase 1. Volume 1: PDU operations
[DOE/ET-10296/66-VOL-1] N81-20296

MOLYBDENUM
Aspects of metal NMR and high sensitivity probe design N81-20201
Concentration dependent thermal release of helium-3 implanted in molybdenum N81-20241

MOLYBDENUM COMPOUNDS
Reactions of metal-metal multiple bonds. 8: Forming Mo-Mo quadruple bonds by reductive elimination (alkyl group disproportionation) in the reactions of 1,2-Mo2R2(NMe)4 compounds (M triple bond M) with carbon dioxide and 1,3-Diaryltriazenes
[AD-A095421] N81-20224

MOLYBDENUM DISULFIDES
Dynamics of solid dispersions in oil during the lubrication of point of contacts. Part 2: Molybdenum disulfide
[NASA-TM-81709] N81-20275

MOMENT DISTRIBUTION
Mathematical models for dispersion of chromatographic solute bands N81-20194

MOMENTUM
Measurement of the transverse momenta of partons and of jet fragmentation as a function of square roots in p-p collisions: CCOR Collaboration
[DOE/ER-02232/92] N81-20853

MOMENTUM THEORY
An extension of the local momentum theory to a distorted wake model of a hovering rotor
[NASA-TM-81258] N81-20030

MOMENTUM TRANSFER
Description of a digital computer simulation of an Annular Momentum Control Device (AMCD) laboratory test model
[NASA-TM-81797] N81-20741

MONITORS
A continuous corrosivity monitoring device for naval environments
[AD-A095728] N81-20250

MONOCHROMATORS
A study of impurity transport with an EUV spatial imaging detector system on the Alcator A Tokamak N81-20878

MONTANA
Summary of the western energy overhead monitoring project
[PB81-129009] N81-20531

MONTE CARLO METHOD
A Monte Carlo comparison of robust and resistant estimators of bivariate correlation N81-20785
Collocation method for the solution of the neutron transport equation with both symmetric and asymmetric scattering
[SAND-80-1446] N81-20843
Scoring methods for implicit Monte Carlo radiation transport
[UCID-18858] N81-20852

MORPHOLOGY
Morphological changes in neurons of the hind limb reflex arc during long term immobilization
[NASA-TM-75939] N81-20695
Functional-morphological parallels of the hypothalamo-pituitary-adrenal system response reaction to long-term hypokinesia
[NASA-TM-76001] N81-20716

MOTION PERCEPTION
Physiological factors N81-20094
Simulation technology N81-20095

MOTOR VEHICLES
Motorcycle aerodynamics in performance --- wind tunnel and driving tests
[BU-253] N81-20042

MOVING TARGET INDICATORS
A detection and processing scheme for moving target detection using a passive sensor N81-20815
Numerical target tracking N81-20817

MULTIPLE ACCESS
Bounds on transmission delays for the CCRA --- Capetanakis collision resolution protocol
[AD-A095658] N81-20346

MULTIPROCESSING (COMPUTERS)
A formal methodology using attributed grammar for multiprocessing system design N81-20736

MULTISPECTRAL BAND SCANNERS
Ranking various classifications of the same data from ground truths and contingency tables --- for the reduction of multispectral band scanner image data
[ESA-CR(P)-1388] N81-20766

MULTISPECTRAL PHOTOGRAPHY
Assistance in interpreting satellite multispectral imagery N81-20811

MULTIVARIATE STATISTICAL ANALYSIS
On a class of multivariate exponential densities N81-20786
Tests for dependence in multivariate observations N81-20788
On a class of multivariate negative binomial distributions
[AD-A095445] N81-20793

MUSCLES
Change in energy expenditure and brain and adrenal content of catecholamines in rats during muscular loading and hypokinesia
[NASA-TM-76148] N81-20697
Multifunctional transducer
[NASA-CASE-NPO-14329-1] N81-20703
Effect of inaction on function of fast and slow muscle spindles
[NASA-TM-76374] N81-20720
Study on contraction and relaxation of experimentally denervated and immobilized muscles: Comparison with dystrophic muscles
[NASA-TM-76053] N81-20724

MUSCULAR FUNCTION
Study on contraction and relaxation of experimentally denervated and immobilized muscles: Comparison with dystrophic muscles
[NASA-TM-76053] N81-20724
MUSCULOSKELETAL SYSTEM
Experimental joint immobilization in guinea pigs. Effects on the knee joint
[NASA-TM-76067] N81-20696

N

N-TYPE SEMICONDUCTORS
Electric conduction in n-type germanium and cadmium sulfide
[INPE-1950-RPE/266] N81-20358
NASA PROGRAMS
NASA progress in aircraft noise prediction
[NASA-TM-81915] N81-20830
Limitless Horizons. Careers in Aerospace
[NASA-EP-171] N81-20947
Beyond the atmosphere: Early years of space science
[NASA-SP-4211] N81-20962
NASA gets under way N81-20970
External relations N81-20971
Deepening perspective: A new look at the old world --- satellites and the earth sciences N81-20973
Who decides? --- program proposals; relations between NASA and the scientific community N81-20974
The universities: Allies and rivals to NASA N81-20975
Programs, projects, and headaches --- NASA central program management and the field centers N81-20976
Jet Propulsion Laboratory: Outsider or insider? N81-20977
Life sciences: No place in the Sun --- NASA management N81-20978
Leadership and changing times --- nasa management N81-20979
International ties --- international cooperation in the space sciences N81-20980
Objectives, plans, and budgets --- nasa programs N81-20983
Review and assessment --- NASA space program N81-20984
NASTRAN
A comparison of damping synthesis methods for space vehicle dynamic analysis
[CNES-80/CT/PRT/SST/SM/316] N81-20171
NATURAL LANGUAGE (COMPUTERS)
Advanced Query Facility
[AD-A095717] N81-20950
Memory, meaning and syntax
[AD-A095451] N81-20951
NAVIER-STOKES EQUATION
Numerical solution of three-dimensional Navier-Stokes equations on an arbitrarily shaped body using a locally one-dimensional scheme N81-20023
Finite element simulations of stratified flow over simple geometrical obstructions and arbitrarily complex terrain N81-20607
NAVIGATION AIDS
Loran-C plotting program for plotting lines of position on standard charts
[NASA-CR-164082] N81-20052
NAVIGATION INSTRUMENTS
Error analysis and performance data from an automated azimuth measuring system
[AD-A095446] N81-20057
NEAR FIELDS
Waveguide model N81-20332
NEODYMIUM LASERS
Laser-initiated, reduced density channels for transporting charged particle beams
[AD-A095725] N81-20415
Evidence for self-focusing or filamentation from X-ray, 3/2 omega 0, and 2 omega 0 emission
[AD-A095450] N81-20416
Characteristics of ablation plasma from planar, laser-driven targets
[AD-A095667] N81-20891
NEON
Study of the ionization of C, N, O, Nr, Kr and Xe positive ions by electron impact
[ORNL-TR-4702] N81-20841
NERVES
Surgical access to separate branches of the cat vestibular nerve
[NASA-TM-76478] N81-20715
NETWORK ANALYSIS
Wind generator network methodology and analysis N81-20356
Performance analysis of distributed database systems N81-20734
Star network distributed computer systems evaluation results
[AD-A095687] N81-20743
Multiple finite source queueing model with fixed priority scheduling N81-20756
Distributed routing
[AD-A095385] N81-20762
Minimum S-T cut of a planar undirected network in O(n log2(n)) time
[AD-A095539] N81-20774
NETWORK CONTROL
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG), volume 1
[NASA-CR-164051] N81-20538
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 3, appendix B: State of the art, trends, and potential growth of selected DSG technologies
[NASA-CR-164054] N81-20540
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 4, appendix C: Identification from utility visits of present and future approaches to integration of DSG into distribution networks
[NASA-CR-164055] N81-20541
Multiple finite source queueing model with fixed priority scheduling N81-20756
NETWORKS
Monolithic integrated semiconductor switches with low on-resistance --- for private automatic branch exchange (PABX) applications
[BMFT-FB-T-80-016] N81-20373
NEURONS
Morphological changes in neurons of the hind limb reflex arc during long term immobilization
[NASA-TM-75939] N81-20695
NEUTRAL GASES
Virgo cluster galaxies: Neutral hydrogen studies N81-20991
NEUTRINOS
Ghost neutrinos in Einstein-Cartan theory --- a Newman-Penrose type formalism
[MATH-RES-146] N81-20945
A Newman-Penrose type formalism for space-times with torsion. Part 3: Neutrino fields in Einstein-Cartan theory
[MATH-RES-147-PT-3] N81-20946
NEUTRON ACTIVATION ANALYSIS
Solvent Refined Coal (SRC) process: Trace elements research and development. Volume 3: Pilot plant development work, part 6: The fate of trace elements in the SRC process
[DOE/ET-10104/T11] N81-20308
NEUTRON IRRADIATION
Development of an irradiation creep correlation for 20% cold-worked AISI 316 in fusion environments: DAFS contribution
[DOE/FF-02170/T58] N81-20475
NEUTRON SCATTERING
Collocation method for the solution of the neutron transport equation with both symmetric and asymmetric scattering
[SAND-80-1446] N81-20843
NEUTRON SPECTRA
Neutron spectra from beam-heated fusion plasmas. Research and Training Program on Controlled Thermonuclear Fusion and Plasma Physics (EUR-NE)
[TRITA-PFU-80-09] N81-20910
NEUTRON STARS
On the origin of the March 5, 1979 gamma ray transient: A vibrating neutron star in the Large Magellanic Cloud
[NASA-TM-80738] N81-21006
NEVADA
Basin development and water allocation
[PB81-127276] N81-20534
NEW JERSEY
Energy emergency contingency plan
[PB81-126704] N81-20604
NEW MEXICO
Summary of the western energy overhead monitoring project
[PB81-129009] N81-20531
NEWTONIAN FLUIDS
Study on fluid phenomena influencing the design of zero-gravity experiments, volume 1
[TS-1-80-VOL-1] N81-20105
The motion of macromolecules and immiscible drops in creeping flow N81-20274
NICKEL ALLOYS
Welding of nickel alloys --- including Inconel and waspaloy
[BMFT-FB-T-79-180] N81-20443
NICKEL CADMIUM BATTERIES
Characterization of the physico-chemical properties of polymeric materials for aerospace flight --- differential thermal and atomic absorption spectroscopic analysis of nickel cadmium batteries
[NASA-CR-164062] N81-20276
NICKEL COMPOUNDS
Characterization of the physico-chemical properties of polymeric materials for aerospace flight --- differential thermal and atomic absorption spectroscopic analysis of nickel cadmium batteries
[NASA-CR-164062] N81-20276
NICKEL PLATE
The high resolution imaging atom-probe with application to nickel platings
[AD-A095254] N81-20251
NIGHTGLOW
Average nocturnal and seasonal variations of sodium nightglow at 23 deg S, 46 deg W
[INPE-1957-RPE/271] N81-20634
NIOBIUM ALLOYS
Microstructure and properties of A15 superconductors formed by direct precipitation
[LBL-11605] N81-20367
Effects of strain on the superconducting properties of niobium-tin conductors
[UCRL-53069] N81-20368
NITRIDES
A feasibility study on the growth of bulk GaN single crystals
[AD-A095553] N81-20932
NITROGEN
Development of unique catalysts for hydrogenitrogenation of coal-derived liquids
[DOE/ET-03297/1] N81-20295
Study of the ionization of C, N, O, Nr, Kr and Xe positive ions by electron impact
[ORNL-TR-4702] N81-20841
NOBLE METALS
Recovery and use of fission product noble metals
[PNL-SA-8358] N81-20258
Structure and properties of light alloys
[TT-76-52003] N81-20263
NOCTURNAL VARIATIONS
Average nocturnal and seasonal variations of sodium nightglow at 23 deg S, 46 deg W
[INPE-1957-RPE/271] N81-20634
NOISE (SOUND)
Psychoacoustic evaluation of transmission line audible noise: Building attenuation effects, methodology comparison, and field study feasibility, volume 1
[DOE/RA-29323/1] N81-20833
NOISE POLLUTION
Annoyance from light aircraft investigation conducted around four airports near Paris
[NASA-TM-76532] N81-20609
Propagation of traffic noise
[PB81-123523] N81-20619
NOISE PREDICTION (AIRCRAFT)
NASA progress in aircraft noise prediction
[NASA-TM-81915] N81-20830
NOISE PROPAGATION
Propagation of traffic noise
[PB81-123523] N81-20619
NOISE REDUCTION
Comments on settling chamber design for quiet, blowdown wind tunnels
[NASA-TM-81948] N81-20085
Psychoacoustic evaluation of transmission line audible noise: Building attenuation effects, methodology comparison, and field study feasibility, volume 1
[DOE/RA-29323/1] N81-20833

NONDESTRUCTIVE TESTS
Deformation characteristics and failure modes of notched graphite polymide composites at room and elevated temperatures --- nondestructive test techniques
[NASA-CR-159375] N81-20185
Acoustic emission monitoring of polymer composite materials
[NASA-TM-76523] N81-20187
Computer techniques for ultrasonic inspection
[AD-A095285] N81-20447
Non-destructive failure prediction for brittle solids
[LBL-10341-REV] N81-20448
Evaluation of nondestructive inspection methods applied to milled step-down areas. Volume 1: Text and tables --- in aluminum alloys
[NLR-TR-78110-U-VOL-1] N81-20450
Evaluation of nondestructive inspection methods applied to milled step-down areas. Volume 2: Figures --- in aluminum alloys
[NLR-TR-78110-U-VOL-2] N81-20451
Development of a new noninvasive method to determine the integrity of bone in vivo
[NASA-CR-160922] N81-20722

NONEQUILIBRIUM FLOW
Nonequilibrium effects in wet-steam turbines N81-20430

NONFLAMMABLE MATERIALS
Study of materials performance model for aircraft interiors
[NASA-CR-152378] N81-20063

NONLINEAR EQUATIONS
Extension of Volterra analysis to weakly nonlinear electromagnetic field problems with application to whistler propagation --- cold collisionless electron plasma N81-20319
A linearization technique for the dynamic response of nonlinear continuae N81-20456
Guaranteed component-wise point-wise error bounds for approximate solutions of nonlinear two-point boundary value problems using an improved Kantorovich-like theorem N81-20740

NONLINEAR EVOLUTION EQUATIONS
Studies in nonlinear motion
[AD-A095559] N81-20777

NONLINEAR OPTICS
Some aspects of the comparison between optics and nonlinear acoustics
[NASA-TM-75859] N81-20802
Nonlinear optical effects in liquid crystals --- second-harmonic generations
[AD-A095368] N81-20934

NONLINEAR PROGRAMMING
Continuity of the optimal value function under the Mangasarian-Fromovitz Constraint Qualification
[AD-A095422] N81-20800

NONLINEAR SYSTEMS
The 3D solid element (type 4 - elastic or elastic-perfectly-plastic) for the ANSR-11 program --- nonlinear structural response
[PB81-123242] N81-20485
Functional series identification of nonlinear systems for adaptive control N81-20758
Studies in nonlinear motion
[AD-A095559] N81-20777
Some aspects of the comparison between optics and nonlinear acoustics
[NASA-TM-75859] N81-20802
Nonlinear optical effects in liquid crystals --- second-harmonic generations
[AD-A095368] N81-20934

NONLINEARITY
Optimal linear approximation in project compression
[AD-A095757] N81-20799
Nonlinear optical phase conjugation by 3-wave and 4-wave mixing N81-20862

NONSYNCHRONIZATION
A technique for recovering nonsynchronized data from a digital flight data recorder N81-20020

NONUNIFORM FLOW
Blade vibration excitation and sound generation by flow nonuniformities N81-20429

NORTH CAROLINA
Water resources in North Carolina
[PB81-127318] N81-20533

NORTH POLAR SPUR (ASTRONOMY)
The nature of the spatial structure of diffuse soft X-rays in the direction of the North Polar Spur N81-21004

NOTCH SENSITIVITY
Deformation characteristics and failure modes of notched graphite polymide composites at room and elevated temperatures --- nondestructive test techniques
[NASA-CR-159375] N81-20185

NOZZLE FLOW
Dual nozzle aerodynamic and cooling analysis study
[NASA-CR-161677] N81-20175
Turbulent mixing and concentration measurement --- in nozzle flows N81-20390

NUCLEAR EXPLOSION EFFECT
The Roscoe Manual. Volume 2-1: Sample case --- nuclear explosion effects
[AD-A095535] N81-20742

NUCLEAR EXPLOSIONS
Body and surface wave modeling of observed seismic events
[AD-A095690] N81-20645
International seismological data center: Procedures to check events through dynamic information and to estimate magnitudes --- monitoring for the nuclear test ban treaty
[FOA-C-20368-T1] N81-20648

NUCLEAR FUSION
Review of fusion synfuels
[BNL-28627] N81-20300
Two-centre Coulomb phaseshifts and radial functions
[IPPJ-AM-16] N81-20888
Massachusetts Institute of Technology, Plasma fusion center, technical research programs
[DOE/ET-52002/T1] N81-20900
Charged-particle cross section data for fusion plasma applications
[COO-2218-195] N81-20902
Consistency of the standard model of primordial nucleosynthesis: Response to the comment of Olive and Turner
[NASA-TM-82082] N81-20994

NUCLEAR MAGNETIC RESONANCE
Aspects of metal NMR and high sensitivity probe design N81-20201
Hydrogen bonding in asphaltenes and coal liquids
[DOE/PC-30252/T1] N81-20227

NUCLEAR POWER REACTORS
Commerical tandem mirror reactor design with thermal barriers: WITAMIR-I
[UWFDM-375] N81-20887

NUCLEAR REACTIONS
Symmetric tandem mirror program
[DOE/ET-51017/T1] N81-20894
Fusion technology development: First wall/blanket system and component testing in existing nuclear facilities
[EGG-FT-5281] N81-20903

NUCLEAR REACTORS
Acoustic emission. Flaw relationship for in-service monitoring of nuclear pressure vessels
[PNL-SA-8691] N81-20834

NUCLEAR RESEARCH
Symmetric tandem mirror program
[DOE/ET-51017/T1] N81-20894

NUCLEAR RESEARCH AND TEST REACTORS
Fusion technology development: First wall/blanket system and component testing in existing nuclear facilities
[EGG-FT-5281] N81-20903

NUCLEAR SPIN
Temperature dependences of hyperfine fields at SP-impurities in fcc-cobalt studied by nuclear spin precession following heavy-ion reactions N81-20926

NUCLEAR VULNERABILITY
Nuclear survivability/vulnerability of aircrews: An experimental approach
[AD-A095501] N81-20729

NUMERICAL ANALYSIS
A study of flame spreading and combustion processes in solid propellant cracks N81-20214
Utilization of an efficient numerical method for viscous flow problem solutions
[AD-A095758] N81-20396
Numerical procedure for predicting the torsional dynamic response of solid media N81-20460
Breaking solutions of the variable coefficient Korteweg-deVries equation --- ocean surface
[AD-A095247] N81-20687
Alternating-direction implicit numerical solution of the time dependent, three-dimensional, Singlt fluid, resistive magnetohydrodynamic equations
[UCRL-53086] N81-20780

NUMERICAL CONTROL
Controller for computer control of brushless dc motors --- automobile engines
[NASA-CASE-NPO-13970-1] N81-20352

NUMERICAL INTEGRATION
A strain-space plasticity theory and numerical implementation N81-20458
New formulation of backward differenced linear multistep methods for ordinary differential equations
[UCID-18825] N81-20779

NUTATION
Natural nutation damping due to the ergols of the hot gaz propulsion system. Synthesis of MV1 and MV2 in-flight results
[CNES-79/CT/PRT/SST/SS/166] N81-20170

NUTATION DAMPERS
Synthesis of work concerning eddy current pendular nutation dampers. Application of theory to equipment qualification and verification on a spin simulator
[CNES-78/CT/PRT/SST/SS/197] N81-20169

NYLON (TRADEMARK)
Permeation of protective garment material by liquid halogenated ethanes and a polychlorinated biphenyl
[LA-8572-MS] N81-20732

O

O RING SEALS
Ultrasonic weld sealing of M55 stab detonators
[AD-A095343] N81-20436

OBSERVABILITY (SYSTEMS)
Determination of the degree of observability in linear control systems N81-20355

OCCUPATION
Limitless Horizons. Careers in Aerospace
[NASA-EP-171] N81-20947

OCCURRENCES
Infinite frequency interpretations of minimal bases --- factorizations of rational matrices
[MATH-RES-148] N81-20783

OCEAN BOTTOM
Resolving the heat-flow anomaly at the Galapagos Spreading Center N81-20625
Reflection and transmission of obliquely incident Rayleigh waves at a vertical discontinuity N81-20629
Geophysical investigations of the southern continental margin of Australia and the conjugate sector of East Antarctica N81-20632
Some large scale aspects of the Southern Ocean and its environment N81-20685

OCEAN SURFACE
Critical evaluation of the radiometric requirements of satellite onboard equipment for the measurement of ocean color
[ESA-CR(P)-1390] N81-20526
Mixing, convection, and advection in the upper ocean N81-20684
Some large scale aspects of the Southern Ocean and its environment N81-20685
Satellite altimetric measurements of the ocean. Report of the TOPEX Science Working Group
[NASA-CR-164087] N81-20686
Breaking solutions of the variable coefficient Korteweg-deVries equation --- ocean surface
[AD-A095247] N81-20687
The optical contrast of land and sea targets N81-20804

OCEAN TEMPERATURE
A look at remote sensing of the ocean temperature structure
[AD-A095644] N81-20524

OCEAN THERMAL ENERGY CONVERSION
Current-wave spectra coupling project, volume 4. Part A: Formulation of the three-dimensional structure of storm-generated currents. Part B: Summaries of volumes 1, 2 and 3 --- hurricane conditions at potential otec sites
[DOE/SF-20235/T1-VOL-4] N81-20689

OCEANOGRAPHIC PARAMETERS
A mathematical model for how ionospheric reflection degrades sea-echo spectra
[PB81-108359] N81-20652

OCEANS
Carbon dioxide and climate: A bibliography [DOE/TIC-3382] N81-20677
OCULOMOTOR NERVES
Objective appraisal of tolerance to ventriculography with various radiocontrast media (according to electronystagmography data) [NASA-TM-76340] N81-20721
OGIVES
Further studies on magnus phenomena on spinning and coning bodies [AD-A095193] N81-20032
OMNIDIRECTIONAL ANTENNAS
Diversity techniques for omnidirectional telementry coverage of the HiMAT research vehicle [NASA-TP-1830] N81-20074
ON-LINE PROGRAMMING
Technical demonstration: An interactive system for image processing N81-20521
OPERATING SYSTEMS (COMPUTERS)
Orbit calculation programs --- choice of hardware and implementation in function of mission requirements N81-20117
Technical demonstration: An interactive system for image processing N81-20521
A method for adaptive performance improvement of operation systems N81-20757
OPERATIONAL PROBLEMS
Uses of AIDS data in airlines engine maintenance N81-20016
OPERATIONS RESEARCH
The traveling salesman (0,2) matchings [AD-A095716] N81-20775
OPERATOR PERFORMANCE
Teamwork in target Acquisition N81-20808
OPERATORS (MATHEMATICS)
Finite-difference method for the arbitrary cross-section waveguide problem using the best-fit boundary approximation [INPE-1956-RPE/270] N81-20049
Self-consistent many body theory for the standard basis operator Green's functions [INPE-1962-RPE/275] N81-20942
OPTICAL COMMUNICATION
Short transit time photoconductive detectors for high speed optical communication N81-20320
Semiconductor devices for optical communications in 1 micron band of wavelength --- gallium indium arsenide phosphide lasers and diodes [NASA-TM-75869] N81-20867
Exploratory development model hermaphroditic fiber optic connectors [AD-A095276] N81-20871
Development of components for optical communications with light guiding fibers [BMFT-FB-T-80-006] N81-20874
OPTICAL DATA PROCESSING
Study of a real-time X-Y addressable spatial filter --- for onboard satellite optical data processing [CD-6500621/3] N81-20154
OPTICAL EQUIPMENT
The Passive Optical Sample Assembly (POSA) on STS-1 [NASA-TM-82407] N81-20868
OPTICAL FILTERS
Further development of a novel solar cell concentrator photovoltaic converter system [SAND-80-7072] N81-20572
OPTICAL MEASUREMENT
Optical measurements of the diffusion of a heavy gas in turbulent boundary layer --- inside a wind tunnel N81-20391
OPTICAL MEASURING INSTRUMENTS
Strapdown inertial optical system (SIOS) --- for observation and communication satellites [REPT-0002/DX60] N81-20153
OPTICAL MEMORY (DATA STORAGE)
Solid state imagers --- imaging and image storage [BMFT-FB-T-80-009] N81-20875
OPTICAL PROPERTIES
Cost/performance of solar reflective surfaces for parabolic dish concentrators [NASA-CR-164088] N81-20547
GIRL: German Infrared Laboratory. Telescope study, phase B [NASA-TM-75911] N81-20866
The retardation of crystallization of CVD amorphous silicon and the study of its structural and optical properties N81-20912
Experimental and theoretical studies of donor-type graphite intercalated compounds [AD-A095282] N81-20935
OPTICAL RADAR
Lidar observations at 0.7 micrometers and 10.6 micrometers wavelengths during Smoke Week 2 [AD-A095356] N81-20341
Balloonborne lidar experiment --- atmospheric density measurements [AD-A095366] N81-20642
Measurements of lidar backscattering from clouds [DFVLR-MITT-80-12] N81-20681
OPTICAL SCANNERS
Geometrical quality of scanning sensor imagery --- from earth satellites N81-20501
OPTICAL WAVEGUIDES
Ultra low loss optical fiber cable assemblies [AD-A095551] N81-20870
OPTIMAL CONTROL
Function space variable metric methods with applications to singular optimal control computation N81-20759
OPTIMIZATION
Design of a fuel-efficient guidance system for a STOL aircraft [NASA-TM-81256] N81-20006
The optimum design of by-pass engines with jet mixing [PNR-90017] N81-20081
Optimal distribution of thermal insulation and ground heat losses [PB81-122871] N81-20317
High speed velocity measurements using laser-Doppler anemometers --- application to turbulent fluid flows and measurement optimization N81-20388
On the optimal maintenance of reliability systems N81-20445
A method to tune the various components of a solar heating system --- economic factors and cost analysis N81-20552
Optimization of storage in passive solar heating systems [DOE/CS-35405/T1] N81-20574
Minimum S-T cut of a planar undirected network in O(n log2(n)) time [AD-A095539] N81-20774
Bayesian optimal designs for surveillance procedures in attribute life testing [AD-A095723] N81-20796
Optimal linear approximation in project compression [AD-A095757] N81-20799
Continuity of the optimal value function under the Mangasarian-Fromovitz Constraint Qualification [AD-A095422] N81-20800
ORBIT CALCULATION
Extrapolation of orbits N81-20114
Measurement for orbit determination --- comparison of ground based satellite position observation techniques N81-20115
Orbit calculation programs --- choice of hardware and implementation in function of mission requirements N81-20117
Choice and acquisition of the SPOT satellite orbit N81-20131
Interplanetary orbit control N81-20137
Space vehicle atmospheric reentry trajectories N81-20140
Natural reentry of satellites: SKYLAB --- orbit calculations N81-20141
The reentry of SKYLAB: Reentry tracking and orbit calculation [CNES-CT/EMT/MT/MS/208] N81-20143
On the orbits used for Earth observation missions --- their parametrization and calculation N81-20502
ORBIT PERTURBATION
Perturbed ellipical motion --- theory and application to calculating orbits around the Earth N81-20110
Orbit perturbation: Causes and representation N81-20112
Orbit perturbations: The effects --- elliptical orbits N81-20113
Geostationary satellite stationkeeping. Orbit perturbation --- and correction N81-20128
Accuracy of gravitational physics tests using ranges to the inner planets [NASA-CR-164080] N81-20998
ORBITAL ELEMENTS
Analyses of the US Navy orbits of 1963-24B and 1974-34A at 15th order resonance [RAE-TR-80093] N81-20142
On the orbits used for Earth observation missions --- their parametrization and calculation N81-20502
ORBITAL MANEUVERS
Interplanetary orbit control N81-20137
ORBITAL MECHANICS
Study of certain launching techniques using long orbiting tethers [NASA-CR-164060] N81-20107
Space vehicle orbital motion --- conferences [ISSN-0244-8041] N81-20108
Perturbed ellipical motion --- theory and application to calculating orbits around the Earth N81-20110
Attitude and orbit command --- guidance with spin stabilization or three axis stabilization N81-20119
Principles and sensors for attitude measurement --- satellite applications N81-20120
Space missions and orbit/attitude systems N81-20126
Positioning a geostationary satellite N81-20127
A scanning satellite. Maintaining the orbit. SPOT N81-20130
The calculation of interplanetary trajectories --- for spacecraft N81-20136
ORBITAL POSITION ESTIMATION
Methods of localization by satellites in the ARGOS system N81-20134
ORBITS
Orbits near triple collision in the three body problem N81-20769
A proof of the existence of unstable periodic orbits using computer-based techniques N81-20770
OREGON
Identification of irrigation practices using photographic and optical-mechanical scanning remote sensing techniques N81-20487
Portland IAP, Portland, Oregon, Revised Uniform Summary of Surface Weather Observations (RUSSWO), parts A-F [AD-A095329] N81-20675
ORGANIC COMPOUNDS
The photochemical transformations of organic compounds in seawater N81-20200
ORGANIC MATERIALS
Elemental distributions of biological materials by ion microscopy N81-20211
ORGANIZATIONS
Data bases available at the National Bureau of Standards library [PB81-132870] N81-20955
ORGANOMETALLIC COMPOUNDS
A study of gas solid reactions and air pollution detectors [AD-A095253] N81-20610
ORTHOPHOTOGRAPHY
Orthophotography and numerical terrain models --- of aerial imagery N81-20506
Analog rectification --- transformation of a council perspective (remote sensor imagery) into an orthogonal cylindrical perspective (map) N81-20516
ORTHOSTATIC TOLERANCE
Activity of the right cardiac ventricle and metabolism in healthy persons during an orthostatic test after short term immobilization [NASA-TM-76519] N81-20726
OSCILLATING FLOW
A panel method to determine loads on oscillating airfoils in transonic flow with embedded shock waves [NLR-MP-80005-U] N81-20039
OTOLOGY
Surgical access to separate branches of the cat vestibular nerve [NASA-TM-76478] N81-20715
OXIDES
Conductivity as a tool for evaluating the homogeneity of sintered discs of transition metal oxides [AD-A095298] N81-20249
OXYGEN
The effect of oxygen and anthraquinone on the alkaline depolymerization of amylose N81-20272
Study of the ionization of C, N, O, Nr, Kr and Xe positive ions by electron impact [ORNL-TR-4702] N81-20841
OXYGEN ATOMS
A theoretical and experimental study on the atomic oxygen corona in the Earth's atmosphere N81-20624

OXYGEN METABOLISM
Activity of certain enzymes in subcellular fractions of rat liver after flight on Cosmos 1129 biosatellite
[NASA-TM-76472] N81-20701

OXYGEN TENSION
Hypoxia in the walls of large blood vessels
N81-20706

OZONE
Atmospheric ozone measurements in Brazil data bulletin no. 1, 1974 - 1976
[INPE-1985-RPE/282] N81-20663

P

P-N JUNCTIONS
The calculation of the current-gain of bipolar transistors and the theory for the forward-biased p-n junction at all injection levels N81-20354

PACIFIC ISLANDS
Evidence for fault asperities from systematic time-domain modeling of teleseimic waveforms
N81-20630

PACKET SWITCHING
Bounds on transmission delays for the CCRA --- Capetanakis collision resolution protocol
[AD-A095658] N81-20346

PAINTS
Determination of the effect of composition structure and electrochemical mass transport properties on adhesion and corrosion inhibition of paint films
[AD-A095293] N81-20278
Degradation of the surface finish of the SPACELAB pallet after ultraviolet irradiation --- paints
[ESA-STM-215] N81-20284

PALLADIUM
Effects of hydrogen on the elastic constants of vanadium and palladium single crystals N81-20242

PANEL METHOD (FLUID DYNAMICS)
A panel method to determine loads on oscillating airfoils in transonic flow with embedded shock waves
[NLR-MP-80005-U] N81-20039

PANORAMIC CAMERAS
Photographic cameras and return beam vidicons --- functioning onboard spacecraft N81-20507

PANORAMIC SCANNING
The geometry of scanning imagery N81-20509

PARABOLIC REFLECTORS
Cost/performance of solar reflective surfaces for parabolic dish concentrators
[NASA-CR-164088] N81-20547

PARALLEL PROCESSING (COMPUTERS)
On probabilistic and symmetric parallel computations
[AD-A095657] N81-20738
Parallel solution of large sparse linear equations using a processor network N81-20754

PARAMETER IDENTIFICATION
Critical parameters for coarse coal underground slurry haulage systems
[JPL-PUB-81-11] N81-20495

PARAMETERIZATION
On the orbits used for Earth observation missions --- their parametrization and calculation N81-20502

PARAMETRIC AMPLIFIERS
The 31.4 GHz parametric amplifier
[NASA-CR-166643] N81-20360
Development of a parametric amplifier for satellite transponder applications at 14 to 14.5 GHz
[BMFT-FB-W-79-27] N81-20375

PARTIAL DIFFERENTIAL EQUATIONS
Numerical solution of three-dimensional Navier-Stokes equations on an arbitrarily shaped body using a locally one-dimensional scheme N81-20023
A linearization technique for the dynamic response of nonlinear continuae N81-20456
Alternating-direction implicit numerical solution of the time dependent, three-dimensional, SingIt fluid, resistive magnetohydrodynamic equations
[UCRL-53086] N81-20780

PARTICLE ACCELERATORS
Concepts and limitations of macroparticle accelerators using traveling magnetic waves
[LA-UR-80-3507] N81-20860

PARTICLE BEAMS
Proceedings of the Beam-Beam Interaction Seminar
[SLAC-PUB-2624] N81-20856
Energization of electrons in a plasma beam entering a curved magnetic field
[TRITA-EPP-80-09] N81-20909

PARTICLE COLLISIONS
Orbits near triple collision in the three body problem N81-20769
Measurement of the transverse momenta of partons and of jet fragmentation as a function of square roots in p-p collisions: CCOR Collaboration
[DOE/ER-02232/92] N81-20853
Semiconductor devices as track detectors in high energy colliding beams experiments
[BNL-28850] N81-20861

PARTICLE DENSITY (CONCENTRATION)
Turbulent mixing and concentration measurement --- in nozzle flows N81-20390

PARTICLE DIFFUSION
On the motions of particles in turbulent flows --- pipe flow N81-20389

PARTICLE PRECIPITATION
Brazilian magnetic anomaly
[INPE-1935-RPE/258] N81-20636

PARTICLE PRODUCTION
Study of direct single photons and correlated particles in proton-proton collisions at square roots = 62-4 GeV (CCOR collaboration)
[DOE/ER-02232/94] N81-20842

PARTICLE SIZE DISTRIBUTION
Explosibility of energetic material dusts
[AD-A095353] N81-20288
Plastic analysis of randomly distributed grains in a tensile specimen
[SAND-80-2780] N81-20473

PARTICLE SPIN
A spin coefficient approach to Weyssenhoff fluids in Einstein-Cartan theory
[MATH-RES-153] N81-20801
A Newman-Penrose type formalism for space-times with torsion. Part 2: Exact plane wave solutions
[MATH-RES-143-PT-2] N81-20944
A Newman-Penrose type formalism for space-times with torsion. Part 3: Neutrino fields in Einstein-Cartan theory
[MATH-RES-147-PT-3] N81-20946

PARTICLES
Chemical and catalytic properties of elemental carbon
[LBL-11678] N81-20229

PARTICULATE SAMPLING
Aerosol analysis for the regional air pollution study
[LBL-6497] N81-20614

PARTITIONS (MATHEMATICS)
An asymptotic expansion for the distribution of the location linear discriminant function
[MATH-RES-149] N81-20784

PARTONS
Measurement of the transverse momenta of partons and of jet fragmentation as a function of square roots in p-p collisions: CCOR Collaboration
[DOE/ER-02232/92] N81-20853

PASCAL (PROGRAMMING LANGUAGE)
Modular file-structured databasing system
[SAND-80-2336C] N81-20953

PASSENGERS
Passenger value structure model: Automated Guideway Transit Technology program
[PB81-120875] N81-20960

PASSIVITY
Passivation of carbon steel through mercury implantation
[NASA-CR-165292] N81-20244

PATHOGENESIS
Pathogenesis of sudden death following water immersion (immersion syndrome)
[NASA-TM-76542] N81-20723
Study on contraction and relaxation of experimentally denervated and immobilized muscles: Comparison with dystrophic muscles
[NASA-TM-76053] N81-20724

PATHOLOGY
Functional-morphological parallels of the hypothalamo-pituitary-adrenal system response reaction to long-term hypokinesia
[NASA-TM-76001] N81-20716

PATTERN RECOGNITION
Classification of petroleum samples from gas chromatographic data by pattern recognition techniques and simulation of mass spectra by regression analysis of structural descriptors
N81-20202
ICAP: An Interactive Cluster Analysis Procedure for analyzing remotely sensed data --- to classify the radiance data to produce a thematic map
[NASA-TM-80732] N81-20494
Hybrid approaches and industrial applications of pattern recognition
[AD-A095582] N81-20763
Image processing
[AD-A095552] N81-20764
Assistance in interpreting satellite multispectral imagery N81-20811
Semi-Automatic and automatic extraction of objects from aerial images N81-20814
Target identification of aircraft using IR/TV-sensor-images N81-20821
Prototype automatic target screener
[AD-A095596] N81-20869

PAVEMENTS
Formulation and evaluation of new adhesives for highway use
[PB81-129835] N81-20286

PAYLOADS
Damping synthesis for ARIANE payload coupled analyses
[CNES-79/CT/PRT/SST/SM/331] N81-20155
Shuttle/payload communications and data systems interface analysis
[NASA-CR-160929] N81-20157
Shuttle/payload communications and data systems interface analysis: Introduction N81-20159
Payload/orbiter signal processing and data handling system evaluation presentation N81-20160
Payloads minimum EIRP formulations N81-20161

PELLETS
Engineering study of pelleting waste paper for energy recovery
[NZERDC-53] N81-20562

PENETROMETERS
Surface penetrators for planetary exploration: Science rationale and development program
[NASA-TM-81251] N81-21000

PENTODES
The 200 kV linear beam switch tube development
[AD-A095505] N81-20363

PERFORATED SHELLS
An experimental study of large compressive loads upon residual strain fields and the interaction between surface strain fields created by coldworking fastener holes N81-20454

PERFORMANCE PREDICTION
Motorcycle aerodynamics in performance --- wind tunnel and driving tests
[BU-253] N81-20042
Flow in a 320 MW low-pressure section: Theoretical and experimental evaluation --- of the steam fluid dynamic behavior and turbine performance
N81-20432
Development of the Coastal Zone Color Scanner for NIMBUS 7. Volume 2: Test and performance data, revision A
[NASA-CR-166649] N81-20491
Performance of air collector house heating systems with rock bed storage --- solar heating N81-20553
Performance analysis of distributed database systems N81-20734
An approach to airborne infrared search set performance modeling N81-20805

PERFORMANCE TESTS
Investigation of Flight Test Methods for measuring the performance of general aviation aircraft
[NASA-CR-164057] N81-20065
Minimum operational performance standards for airborne radar approach and beacon systems for helicopters
[RTCA/DO-172] N81-20322
Minimum operational performance standards for airborne weather and ground mapping pulsed radars
[RTCA/DO-173] N81-20323
Field turbine tests --- of large steam turbine generator units N81-20431
Flow in a 320 MW low-pressure section: Theoretical and experimental evaluation --- of the steam fluid dynamic behavior and turbine performance
N81-20432
LAPR: An experimental aircraft pushbroom scanner
[NASA-TM-80729] N81-20493
Evaluation of a realtime prototype automatic target cuer N81-20823

PERIODIC VARIATIONS
Orbit perturbations: The effects --- elliptical orbits N81-20113
PERIODICALS
Dimensions/NBS. Volume 64, no. 8, October 1980
[PB81-133654] N81-21007
PERMEABILITY
Changes in mast cells and in permeability of mesenteric microvessels under the effect of immobilization and electrostimulation
[NASA-TM-75988] N81-20694
PERMEATING
Permeation of protective garment material by liquid halogenated ethanes and a polychlorinated biphenyl
[LA-8572-MS] N81-20732
PERSONNEL SELECTION
Program for the medical examination (consultation) of cosmonauts
[NASA-TM-76471] N81-20714
PERTURBATION
Tolerence and perturbation analysis N81-20334
Perturbation theory approach to the ground state energy in an infinite Fermion system
[LA-UR-80-3658] N81-20848
PERTURBATION THEORY
Perturbed elliptical motion --- theory and application to calculating orbits around the Earth N81-20110
Orbit perturbations: The effects --- elliptical orbits N81-20113
PETROGRAPHY
The development and evaluation of an automated reflectance microscope system for the petrographic characterization of bituminous coals N81-20488
PETROLOGY
The petrology and geochemistry of the Baltimore Mafic Complex, Maryland N81-20627
PHASE CONJUGATION
Nonlinear optical phase conjugation by 3-wave and 4-wave mixing N81-20862
Ultraviolet phase conjugation and its practical implication
[LA-UR-80-3621] N81-20873
PHASE CONTROL
Phase control during reconstruction of holographically recorded flow fields using real-time holographic interferometry
[NASA-TM-81953] N81-20405
PHASE DIAGRAMS
Structure and properties of light alloys
[TT-76-52003] N81-20263
Advanced methods for preparation and characterization of infrared detector materials --- mercury cadmium tellurides
[NASA-CR-161598] N81-20863
Superstructure phonons and their characterization by Raman Spectroscopy --- zincblende and metal oxides N81-20929
PHASE SHIFT
Two-centre Coulomb phaseshifts and radial functions
[IPPJ-AM-16] N81-20888
PHASE TRANSFORMATIONS
Preparation of high purity vanadium
[IS-M-305] N81-20262
Investigations on processing and properties of high-temperature silicon carbide materials
[BMFT-FB-T-79-170] N81-20282
The benefits of advanced heat storage systems --- solar energy, phase changes, encapsulation, heat of fusion N81-20551
PHONONS
A strong coupled electron-acoustic phonon system in one dimension N81-20925
Superstructure phonons and their characterization by Raman Spectroscopy --- zincblende and metal oxides N81-20929
PHOSPHORUS
Extrinsic specific heat of phosphorus doped silicon
[INPE-1942-RPE/261] N81-20216
PHOTOACOUSTIC SPECTROSCOPY
A chromatographic and spectroscopic characterization of chemically bonded stationary phases N81-20195
The application of photoacoustic spectroscopy to electronic spectroscopy of crystalline solids N81-20196
PHOTOCHEMICAL REACTIONS
The photochemical transformations of organic compounds in seawater N81-20200
Ultraviolet laser photochemistry of halogenated methanes
[LA-UR-80-2798] N81-20233
Nonequilibrium photochemical reactions induced by lasers
[DOE/ET-33056/15] N81-20594
Soot in the atmosphere
[LBL-11676] N81-20616
A simple static photochemical transport model for application to the upper atmospheres of Earth, Mars and Venus
[BMFT-FB-W-79-35] N81-20650
PHOTOCONDUCTIVITY
Short transit time photoconductive detectors for high speed optical communication N81-20320
PHOTODISSOCIATION
Ultraviolet photodissociation of molecular beams
[AD-A095472] N81-20835
Single photon excimer laser photodissociation of highly vibrationally excited polyatomic molecules
[LA-UR-80-3459] N81-20847
Theoretical studies of highly ionized species
[DOE/ER-02887/2] N81-20850
PHOTOELASTICITY
Photoelastic studies of internal stress distributions of unidirectional composites
[AD-A095595] N81-20190
PHOTOELECTRIC EFFECT
Importance of photoelectronystagmography for clinical study of the vestibular function
[NASA-TM-76404] N81-20713
PHOTOELECTRON SPECTROSCOPY
Non-adiabatic capture of mobile electrons in aqueous solution
[AD-A095524] N81-20836
PHOTOGRAMMETRY
Principles of photogrammetry --- the geometry of scene identification and analysis N81-20504
Apparatus for reconstruction --- of photogrammetric data; operational specifications N81-20505
Positioning SPOT images: Reconstitution from a stereoscopic pair --- and photogrammetric implications N81-20510
Applied research in analytical photogrammetry
[PB81-127300] N81-20530
Orbiter Camera Payload System
[NASA-CR-160937] N81-20865
PHOTOGRAPHIC RECORDING
Technical demonstration: A high density image visualization system --- for producing a photographic print from video data N81-20522
PHOTOINTERPRETATION
Identification of irrigation practices using photographic and optical-mechanical scanning remote sensing techniques N81-20487
Teamwork in target Acquisition N81-20808
Assistance in interpreting satellite multispectral imagery N81-20811
Semi-Automatic and automatic extraction of objects from aerial images N81-20814
PHOTOIONIZATION
A theoretical and experimental study on the atomic oxygen corona in the Earth's atmosphere N81-20624
PHOTOMAPPING
Spaceborne cartography of the Earth --- conference; Toulouse, 5-19 Jun. 1979 N81-20496
PHOTOMETERS
Ionization and emission processes in the auroral and equatorial ionosphere --- support services for operation and data analysis
[AD-A095296] N81-20647
PHOTONS
Study of direct single photons and correlated particles in proton-proton collisions at square roots = 62-4 GeV (CCOR collaboration)
[DOE/ER-02232/94] N81-20842
PHOTOVOLTAIC CELLS
High concentration silicon photovoltaic cell development
[SAND-80-7068] N81-20595
The 10-kilowatt photovoltaic concentrator array fabrication
[SAND-80-7062] N81-20599
PHOTOVOLTAIC CONVERSION
Further development of a novel solar cell concentrator photovoltaic converter system
[SAND-80-7072] N81-20572
Experimental study to define developments for terrestrial solar cell generators
[BMFT-FB-T-79-143] N81-20600
PHOTOVOLTAIC EFFECT
Photovoltaics information user study
[SERI/TR-751-852] N81-20570
PHYSICAL EXAMINATIONS
Program for the medical examination (consultation) of cosmonauts
[NASA-TM-76471] N81-20714
PHYSICAL FITNESS
Tolerance of Lower Body Negative Pressure (LBNP) in endurance runners, weightlifters, swimmers and nonathletes N81-20708
PHYSICAL PROPERTIES
Selected physical and thermal properties of various formulations of silicone potting compounds
[MHSMP-80-63] N81-20235
PHYSIOLOGICAL EFFECTS
The effect of immobilization and 3 (beta-aminoethyl)-1, 2, 4 triazol on the calcium content in gastric tissues of guinea pigs during the formation of experimental ulcers
[NASA-TM-75992] N81-20691
Effect of six-month hypokinesia in dogs on mineral component, reconstruction and mechanical properties of bone tissue
[NASA-TM-76168] N81-20698
Preliminary results of scientific research on biosatellite Kosmos-1129
[NASA-TM-76287] N81-20700
Effect of inaction on function of fast and slow muscle spindles
[NASA-TM-76374] N81-20720
Psychoacoustic evaluation of transmission line audible noise: Building attenuation effects, methodology comparison, and field study feasibility, volume 1
[DOE/RA-29323/1] N81-20833
PHYSIOLOGICAL FACTORS
Physiological factors N81-20094
PHYSIOLOGICAL RESPONSES
Activity of certain enzymes in subcellular fractions of rat liver after flight on Cosmos 1129 biosatellite
[NASA-TM-76472] N81-20701
Pathogenesis of sudden death following water immersion (immersion syndrome)
[NASA-TM-76542] N81-20723
The functional status of the human vestibular analysor following 56 days in an aqueous immersion medium
[NASA-TM-75888] N81-20725
PHYSIOLOGICAL TESTS
Program for the medical examination (consultation) of cosmonauts
[NASA-TM-76471] N81-20714
PHYSIOLOGY
Orthostatic hypotension
[NASA-TM-75889] N81-20728
PICKLING (METALLURGY)
Galvanizing
[PB81-120271] N81-20271
PIEZOELECTRIC CRYSTALS
A study of gas solid reactions and air pollution detectors
[AD-A095253] N81-20810
PIEZOELECTRIC TRANSDUCERS
Transient analysis of vibrations in nonideal multilayered piezoelectric devices
[SAND-80-1909] N81-20937
PILOT PLANTS
Development of high-temperature turbine subsystem technology to a technology readiness status, phase 2
[FE-1808-96] N81-20440
PILOT TRAINING
A pilot training manual for the terminal configured vehicle electronic horizontal situation indicator
[NASA-TM-81959] N81-20044
Fidelity of simulation for pilot training
[AGARD-AR-159] N81-20091
Fidelity of simulation for pilot training. Introduction N81-20092
Pilot training N81-20093
Physiological factors N81-20094
Conclusions and recommendations --- training simulator requirements and objectives N81-20096
Assessment of training effectiveness N81-20097
Visual system Technology: Status and problems --- training simulators N81-20099

PILOTS (PERSONNEL)
Pilot assessment of Training simulators N81-20098
PINCH EFFECT
Neoclassical current effects in neutral beam-heated Tokamaks [ORNL/TM-7611] N81-20899
PIPE FLOW
On the motions of particles in turbulent flows --- pipe flow N81-20389
PIPELINES
Critical parameters for coarse coal underground slurry haulage systems [JPL-PUB-81-11] N81-20495
PIPES (TUBES)
Cermet-bonded metal pins for weldable electrical feedthroughs in alumina [MLM-2796(OP)] N81-20279
Detection of water induction in steam turbines [EPRI-CS-1604] N81-20438
Dynamic piping fracture coupled with system effects [EPRI-NP-1640] N81-20470
Cyclic inelastic buckling of tubular steel braces [PB81-124885] N81-20484
PITCHING MOMENTS
Unsteady airloads on a harmonically pitching wing with external store [NLR-MP-80004-U] N81-20038
PITUITARY GLAND
Functional-morphological parallels of the hypothalamo-pituitary-adrenal system response reaction to long-term hypokinesia [NASA-TM-76001] N81-20716
PLANAR STRUCTURES
'Finite part' electric and magnetic stored energies for planar antennas [NASA-TM-81955] N81-20336
PLANE WAVES
A theoretical study of microwave beam absorption by a rectenna [NASA-CR-160921] N81-20328
Plane wave derivation N81-20330
Current sheet model N81-20331
A FORTRAN computer program for calculating the propagation of plane, cylindrical or spherical finite amplitude waves [AD-A095386] N81-20832
A Newman-Penrose type formalism for space-times with torsion. Part 2: Exact plane wave solutions [MATH-RES-143-PT-2] N81-20944
PLANETARY BOUNDARY LAYER
Determination of regional evapotranspiration using energy balance, planetary boundary layer transfer coefficients and regularly recorded data N81-20626
PLANETARY GEOLOGY
The composition of the Martian dark regions: Observations and analysis [NASA-CR-164072] N81-20999
PLANETARY ORBITS
Accuracy of gravitational physics tests using ranges to the inner planets [NASA-CR-164080] N81-20998
PLANETARY ROTATION
The solar system --- description and physics N81-20135
PLANETARY SURFACES
Surface penetrators for planetary exploration: Science rationale and development program [NASA-TM-81251] N81-21000
PLANETOLOGY
Surface penetrators for planetary exploration: Science rationale and development program [NASA-TM-81251] N81-21000
PLANKTON
Laboratory tank studies of a single species of phytoplankton using a remote sensing fluorosensor [NASA-TP-1821] N81-20492
Critical evaluation of the radiometric requirements of satellite onboard equipment for the measurement of ocean color [ESA-CR(P)-1390] N81-20526
PLASMA CHEMISTRY
Plasma chemistry for inorganic materials [NASA-TM-75844] N81-20889
PLASMA CONTROL
Drift-cyclotron loss-cone instability in the presence of the external wave fields N81-20885
Research during 1979 in plasma physics and controlled fusion [TRITA-PFU-80-01] N81-20890
Symmetric tandem mirror program [DOE/ET-51017/T1] N81-20894
Massachusetts Institute of Technology, Plasma fusion center, technical research programs [DOE/ET-52002/T1] N81-20900
Fusion studies program [DOE/ET-52025/3] N81-20906
PLASMA DENSITY
Absorption of laser radiation in a plasma with subcritical density [UCRL-TRANS-11633] N81-20905
PLASMA DIAGNOSTICS
A study of impurity transport with an EUV spatial imaging detector system on the Alcator A Tokamak N81-20878
Plasma fluctuation measurements in ELMO Bumpy Torus [ORNL/TM-7530] N81-20898
PLASMA DRIFT
Drift-cyclotron loss-cone instability in the presence of the external wave fields N81-20885
PLASMA DYNAMICS
Impact of plasma wall interactions on the burn dynamics of Tokamak reactors N81-20883
PLASMA EQUILIBRIUM
Energy principle with global invariants --- equilibria in toroidal plasmas N81-20879
PLASMA GUNS
Formation of compact toroidal plasmas by magnetized coaxial plasma gun injection into an oblate flux conserver [UCRL-85122] N81-20895
Physical properties of compact toroids generated by a coaxial source [LA-UR-80-3238] N81-20896
PLASMA HEATING
Solar coal gasification [DOE/TIC-11384] N81-20587
Symmetric tandem mirror program [DOE/ET-51017/T1] N81-20894
Axial shock wave heating of reversed-field theta-pinch plasmas [MSNW-81-1158-1] N81-20908
PLASMA INTERACTIONS
Impact of plasma wall interactions on the burn dynamics of Tokamak reactors N81-20883
PLASMA JETS
Recent work on an RF ion thruster [NASA-TM-81734] N81-20178
Energization of electrons in a plasma beam entering a curved magnetic field [TRITA-EPP-80-09] N81-20909
PLASMA PHYSICS
Measurement of the transverse momenta of partons and of jet fragmentation as a function of square roots in p-p collisions: CCOR Collaboration [DOE/ER-02232/92] N81-20853
Energy principle with global invariants --- equilibria in toroidal plasmas N81-20879
Research during 1979 in plasma physics and controlled fusion [TRITA-PFU-80-01] N81-20890
PLASMA PINCH
An experimental study of finite Larmor radius effects in a linear Z-pinch N81-20886
Neoclassical current effects in neutral beam-heated Tokamaks [ORNL/TM-7611] N81-20899
PLASMA POWER SOURCES
Simplified power supplies for ion thrusters [NASA-TM-81725] N81-20177
PLASMA SPRAYING
Fabrication of amorphous silicon solar cells, using an industrial process --- based on a nitride plasma reactor [LEP-80.638.SME-689-A] N81-20602
PLASMA-ELECTROMAGNETIC INTERACTION
Electric fields in the magnetosphere --- plasma-electromagnetic interactions [TRITA-EPP-80-06] N81-20651
PLASMA-PARTICLE INTERACTIONS
Neutron spectra from beam-heated fusion plasmas. Research and Training Program on Controlled Thermonuclear Fusion and Plasma Physics (EUR-NE) [TRITA-PFU-80-09] N81-20910
PLASMAS (PHYSICS)
Evidence for magnetic field reconnection at the Earth's magnetopause [NASA-CR-164066] N81-20637
Structure of the low latitude boundary layer [NASA-CR-164056] N81-20638
Characteristics of ablation plasma from planar, laser-driven targets [AD-A095667] N81-20891
Electrode boundary layers in dense, diffuse plasmas [AD-A095250] N81-20892
Investigation of the production of high density uniform plasmas [AD-A095508] N81-20893
PLASTIC PROPERTIES
Metallurgical characterization of superplastic forming [AD-A095720] N81-20255
A strain-space plasticity theory and numerical implementation N81-20458
PLATELETS
Platelet mechanism of erosion of ductile metals [LBL-11341-REV] N81-20261
PLATES (STRUCTURAL MEMBERS)
Experimental studies of the delamination mechanisms in impacted fiber-reinforced composite plates N81-20183
PLENUM CHAMBERS
Two-dimensional adaptive-wall experiments [AD-A095199] N81-20087
PLOTTING
Loran-C plotting program for plotting lines of position on standard charts [NASA-CR-164082] N81-20052
A statistical data analysis and plotting program for cloud microphysics experiments [NASA-CR-161663] N81-20665
PLUMES
The 1979 Southeastern Virginia Urban Plume Study. Volume 2: Data listings for NASA Cessna aircraft [NASA-TM-81860-2] N81-20608
Atmospheric Studies in Complex Terrain (ASCOT) information survey [UCID-18572] N81-20615
An asymptotic method for determining the transport of heat and matter by creeping flows with strongly variable viscosity; Fluid-dynamic problems motivated by island arc volcanism N81-20633
PLUTONIUM OXIDES
Calculation of the thermodynamic properties of fuel-vapor species from spectroscopic data [ANL-CEN-RSD-80-2] N81-20943
POINT SOURCES
Metal particulate emissions from stationary sources. Volume 2: Characterization of collection filters [PB81-121154] N81-20618
POINTS (MATHEMATICS)
The localization of reference points --- on images and associated digital methodology N81-20514
The closeness of uniform random points in a square and a circle [AD-A095697] N81-20772
On the determination of boundary collocation points for solving some problems for the Laplace operator [TRITA-NA-8006] N81-20782
An asymptotic expansion for the distribution of the location linear discriminant function [MATH-RES-149] N81-20784
POLAR REGIONS
ULF/lower-ELF electromagnetic field measurements in the polar caps [AD-A095283] N81-20343
POLARITY
Fine-scale characteristics of interplanetary sector [NASA-TM-82281] N81-20997
POLES
Infinite frequency interpretations of minimal bases --- factorizations of rational matrices [MATH-RES-148] N81-20783
POLLUTION
Modified factor analysis of selected RAPS (Regional Air Pollution Study) aerosol data --- St. Louis, Missouri area [PB81-120784] N81-20622
POLLUTION MONITORING
Water resources in North Carolina [PB81-127318] N81-20533

The 1979 Southeastern Virginia Urban Plume Study. Volume 2: Data listings for NASA Cessna aircraft
[NASA-TM-81860-2] N81-20608
A study of gas solid reactions and air pollution detectors
[AD-A095253] N81-20610
Aerosol analysis for the regional air pollution study
[LBL-6497] N81-20614
Soot in the atmosphere
[LBL-11676] N81-20616
Metal particulate emissions from stationary sources. Volume 2: Characterization of collection filters
[PB81-121154] N81-20618
Consultation for the H2S and meteorological monitoring program of the Ente Nazional per l'Energia Elecrtrica (ENEL)
[DOE/ET-28502/1] N81-20680

POLYATOMIC MOLECULES
Single photon excimer laser photodissociation of highly vibrationally excited polyatomic molecules
[LA-UR-80-3459] N81-20847

POLYBUTADIENE TETRANITRAMINE
Analysis of RDX and HMX in PBX 9404 by high performance liquid chromatography
[MHSMP-80-55] N81-20307

POLYCHLORINATED BIPHENYLS
Permeation of protective garment material by liquid halogenated ethanes and a polychlorinated biphenyl
[LA-8572-MS] N81-20732

POLYCRYSTALS
Materials and methods for the development of solar energy --- thin film cells
[BMFT-FB-T-80-065] N81-20601

POLYMER MATRIX COMPOSITE MATERIALS
Acoustic emission monitoring of polymer composite materials
[NASA-TM-76523] N81-20187

POLYMERIC FILMS
Molding of polypropylene film armor for radar antenna hardening applications
[AD-A095726] N81-20342
Plastic film performance improvement for heliostats
[SAND-79-8185] N81-20579

POLYMERIZATION
Conference on the use of polymers N81-20285

POLYMERS
Comparative adsorption performance of synthetic absorbents and activated carbons N81-20215

POLYNUCLEAR ORGANIC COMPOUNDS
Polynuclear aromatic compounds. Synthesis and purification
[PB81-125015] N81-20182

POLYPROPYLENE
Raman spectra of highly conducting poly-p-phenylene complexes
[AD-A095660] N81-20218
Molding of polypropylene film armor for radar antenna hardening applications
[AD-A095726] N81-20342

POLYTOPES
The traveling salesman (0,2) matchings
[AD-A095716] N81-20775

POROUS MATERIALS
MARIAH: A finite element computer program for incompressible porous flow problems
[SAND-79-1623] N81-20402

POSITION (LOCATION)
Loran-C plotting program for plotting lines of position on standard charts
[NASA-CR-164082] N81-20052
Methods of localization by satellites in the ARGOS system N81-20134
Position surveillance using one active ranging satellite and time-of-arrival of a signal from an independent satellite
[NASA-CR-166647] N81-20147
The geometry of geodesy --- to determine unknowns in position N81-20497
The localization of reference points --- on images and associated digital methodology N81-20514
Technical demonstration: Apparatus for locating landmarks --- on images N81-20523
Aspects of efficiency robust estimation of location N81-20787
Simple estimation procedures based on rank tests for the one- and two-sample location models N81-20791

POSITION INDICATORS
A pilot training manual for the terminal configured vehicle electronic horizontal situation indicator
[NASA-TM-81959] N81-20044

POSITIONING
Positioning a geostationary satellite N81-20127

POTASSIUM ALLOYS
The electrical resistivity and the thermoelectric ratio of potassium and dilute potassium rubidium alloys below 1 K N81-20919

POTASSIUM CHLORIDES
Diffusional creep of multicomponent systems
[COO-2296-22] N81-20474

POTENTIAL ENERGY
One-dimensional space-charge neutralization of the ion beams
[SAND-80-2545] N81-20844

POTENTIAL FLOW
A green-function method for wave interaction with a submerged body
[PB81-122269] N81-20403

POTOMAC RIVER VALLEY (MD-VA-WV)
Point process models of rainfall N81-20656

POTTING COMPOUNDS
Selected physical and thermal properties of various formulations of silicone potting compounds
[MHSMP-80-63] N81-20235

POWDER METALLURGY
Forging of powder metallurgy gears
[AD-A095556] N81-20247

POWER AMPLIFIERS
High power amplifier 14 GHz for satellite ground stations
[BMFT-FB-T-79-158] N81-20370

POWER CONDITIONING
Evaluation of battery converters based on 4.8-MW fuel cell demonstrator inverter
[DOE/RA-26961/01] N81-20575
The design stuay of a far infrared heterodyne spectrometer assembly, volume 2 --- power conditioner
[ESS/CCG-118-VOL-2] N81-20990

POWER EFFICIENCY
Payloads minimum EIRP formulations N81-20161
Steam turbines for large power outputs N81-20427
Highly efficient welding power supply
[DOE/CS-40023/T1] N81-20441

POWER GAIN
Optical gain in semiconductor lasers
[BMFT-FB-T-79-167] N81-20422

POWER SUPPLY CIRCUITS
Delta electrical load analysis C-141B JACC/CP Aircraft
[AD-A095659] N81-20071
Simplified power supplies for ion thrusters
[NASA-TM-81725] N81-20177

PRECIPITATION (CHEMISTRY)
Microstructure and properties of A15 superconductors formed by direct precipitation
[LBL-11605] N81-20367

PRECIPITATION (METEOROLOGY)
Green River Basin flow forecasting models
[PB81-124448] N81-20529
Revised Uniform Summary of Surface Weather Observations (RUSSWO), Lajes Fld, Terceira, Azores, parts A-F
[AD-A095330] N81-20671
Davison AAF, Ft. Belvoir Virginia, Revised Uniform Summary of Surface Weather Observations (RUSSWO), parts A-F
[AD-A095332] N81-20672
Revised Uniform Summary of Surface Weather Observations (RUSSWO), Maui Optical Site, Mount Halekulia, Hawaii, parts C, E-F
[AD-A095328] N81-20674
Portland IAP, Portland, Oregon, Revised Uniform Summary of Surface Weather Observations (RUSSWO), parts A-F
[AD-A095329] N81-20675

PRECISION
Geometrical correction of images: Methods and performance N81-20517

PREDICTION ANALYSIS TECHNIQUES
Identification of jet engine damages by engine trend analysis LEADS 200 data N81-20014
Description, evaluation, and sensitivity analyses analyses of principal US EPA air quality prediction models
[ANL/EES-TM-111] N81-20611
Tropospheric refractivity profiles inferred from RF measurements Passive Refractive Index by Satellite Monitoring (PRISM)
[AD-A095498] N81-20643

PREDICTIONS
The semi-operational evaluation of the trajectory prediction method for Signal Automatic Radar Processing (SARP) 2 --- air traffic control
[NLR-MP-79038-U] N81-20059
An investigation of high frequency propagation over an auroral sub-auroral path --- prediction of usable frequencies
[RAE-TM-RAD-NAV-138] N81-20350

PRELAUNCH TESTS
Development of the Coastal Zone Color Scanner for NIMBUS 7. Volume 2: Test and performance data, revision A
[NASA-CR-166649] N81-20491

PREMIXED FLAMES
The influence of turbulence on combustion in open pre-mixed flames N81-20198

PREPARATION
Coal preparation using magnetic separation. Volume 5: Evaluation of magnetic coal desulfurization concepts
[EPRI-CS-1517-VOL-5] N81-20302

PREPREGS
Flexure tests of three fibrous composite materials
[FFA-TN-HU-2127-PT-3] N81-20192

PRESIDENTIAL REPORTS
Global future: Time to act. Report to the President on global resources, environment and population N81-20957

PRESSURE DISTRIBUTION
Two-dimensional adaptive-wall experiments
[AD-A095199] N81-20087
Hydrodynamic pressure and added mass for axisymmetric bodies --- finite element method
[PB81-122343] N81-20404

PRESSURE EFFECTS
Fast detonator-activated ball shutter for high explosive experiments
[UCID-18814] N81-20409

PRESSURE OSCILLATIONS
Daily surface pressure variations in Brazil: Their spatial distributions, origins and effects
[INPE-1974-RPE/279] N81-20659

PRESSURE REDUCTION
Dual nozzle aerodynamic and cooling analysis study
[NASA-CR-161677] N81-20175
Dynamic piping fracture coupled with system effects
[EPRI-NP-1640] N81-20470

PRESSURE VESSELS
Mechanisms of elevated temperature rupture in single phase ceramics
[DOE/ER-10591/1] N81-20280
Acoustic emission. Flaw relationship for in-service monitoring of nuclear pressure vessels
[PNL-SA-8691] N81-20834

PRIMERS (EXPLOSIVES)
Safety and characterization tests on HIVELITE composition 300435
[AD-A095352] N81-20291

PRINTING
Technical demonstration: A high density image visualization system --- for producing a photographic print from video data N81-20522

PRIORITIES
Multiple finite source queueing model with fixed priority scheduling N81-20756

PROBABILITY DENSITY FUNCTIONS
On the use of AIDS-data for a statistical analysis of wind shear during the approach N81-20010
The closeness of uniform random points in a square and a circle
[AD-A095697] N81-20772

PROBABILITY DISTRIBUTION FUNCTIONS
Evaluation of a pyrotechnic actuator concept by means of the probit statistical method. Justification of the choice of this method; application; examples of application
[CNES-78/CT/PRT/SST/SE/72] N81-20310
On a class of multivariate negative binomial distributions
[AD-A095445] N81-20793
Further development of new methods for estimating tail probabilities and extreme value distributions
[AD-A095721] N81-20794

Statistics for peak values of multiple coherence [AD-A095460] N81-20795
PROBABILITY THEORY
On probabilistic and symmetric parallel computations [AD-A095657] N81-20738
PROBLEM SOLVING
A unified theory of linear diffusion in multilayered materials N81-20381
Utilization of an efficient numerical method for viscous flow problem solutions [AD-A095758] N81-20396
Function space variable metric methods with applications to singular optimal control computation N81-20759
Solution of homogeneous systems of linear equations arising from compartmental models [ORNL/CSD-70] N81-20778
PROCEEDINGS
Proceedings of the 16th Project Integration Meeting [NASA-CR-164073] N81-20545
The 1980 flywheel technology symposium [CONF-801022] N81-20561
PROCESS CONTROL (INDUSTRY)
Molten salt coal gasification process development unit, phase 1. Volume 1: PDU operations [DOE/ET-10296/66-VOL-1] N81-20296
Crystal defects in large scale integrated circuits of silicon --- and implications for crystal growth process control [BMFT-FB-T-79-156] N81-20369
Mobile digital data acquisition and recording system for geoenergy process monitoring and control [SAND-80-2123] N81-20584
Fabrication of amorphous silicon solar cells, using an industrial process --- based on a nitride plasma reactor [LEP-80.638.SME-689-A] N81-20602
PROCESS HEAT
Solar coal gasification [DOE/TIC-11384] N81-20587
PRODUCT DEVELOPMENT
Ceramic components for gas turbines --- product design and manufacturing specification [BMFT-FB-T-79-153] N81-20281
LAPR: An experimental aircraft pushbroom scanner [NASA-TM-80729] N81-20493
Development of zinc-bromine batteries for utility energy storage [DOE/ET-29345/21] N81-20591
PRODUCTION COSTS
Engineering study of pelleting waste paper for energy recovery [NZERDC-53] N81-20562
PRODUCTION ENGINEERING
Ceramic components for gas turbines --- product design and manufacturing specification [BMFT-FB-T-79-153] N81-20281
The burr must go --- burr removal techniques in industry [PNR-90042] N81-20442
Silver-iron batteries [STU-78-4981] N81-20597
PROGRAM VERIFICATION (COMPUTERS)
A session with Tinker: Interleaving program testing with program design [AD-A095521] N81-20746
PROGRAMMING LANGUAGES
A formal methodology using attributed grammar for multiprocessing system design N81-20736
ADA test and evaluation [AD-A095699] N81-20747
Modularity in non-procedural languages through abstract data types [AD-A095546] N81-20748
Introduction to Praxis [UCRL-52957-REV-1] N81-20753
PROJECT MANAGEMENT
Office of alcohol fuels program plan, FY 1981 [DOE/AF-10001/T2] N81-20293
Management advantages of the standard work breakdown structure proposed by the European Space Agency for space satellite projects N81-20948
Who decides? --- program proposals; relations between NASA and the scientific community N81-20974
Programs, projects, and headaches --- NASA central program management and the field centers N81-20976
Jet Propulsion Laboratory: Outsider or insider? N81-20977
Life sciences: No place in the Sun --- NASA management N81-20978
Leadership and changing times --- nasa management N81-20979
Review and assessment --- NASA space program N81-20984
PROJECT PLANNING
Satellite Power Systems (SPS) concept definition study (Exhibit D). Volume 6, part 1: Cost and Programmatics [NASA-CR-3397] N81-20537
Objectives, plans, and budgets --- nasa programs N81-20983
PROJECTILES
Transonic flow past projectiles with variable nonaxisymmetric cross section [AD-A095376] N81-20033
PROJECTIVE GEOMETRY
The geometry of scanning imagery N81-20509
PROPAGATION MODES
Nonlinear optical phase conjugation by 3-wave and 4-wave mixing N81-20862
PROPELLANT PROPERTIES
Study on additional propellants for field emission thrusters --- ion propulsion propellant properties [FRI-R664] N81-20309
PROPELLANT TESTS
Study on additional propellants for field emission thrusters --- ion propulsion propellant properties [FRI-R664] N81-20309
PROPELLANTS
Explosibility of energetic material dusts [AD-A095353] N81-20288
PROPULSION SYSTEM CONFIGURATIONS
Interplanetary missions: Upcoming technological aspects --- solar sails and solar electric propulsion N81-20138
PROPULSION SYSTEM PERFORMANCE
Free radical propulsion concept [NASA-TM-81770] N81-20180
PROTECTIVE CLOTHING
Permeation of protective garment material by liquid halogenated ethanes and a polychlorinated biphenyl [LA-8572-MS] N81-20732
PROTECTIVE COATINGS
Corrosion control through a better understanding of the metallic substrate/organic coating/interface [AD-A095420] N81-20252
Conference on the use of polymers N81-20285
Alternate protection concepts for second surface silver/glass solar mirrors [PNL-3629] N81-20578
Permeation of protective garment material by liquid halogenated ethanes and a polychlorinated biphenyl [LA-8572-MS] N81-20732
PROTECTORS
Fast detonator-activated ball shutter for high explosive experiments [UCID-18814] N81-20409
PROTON BEAMS
Semiconductor devices as track detectors in high energy colliding beams experiments [BNL-28850] N81-20861
PROTONS
Study of direct single photons and correlated particles in proton-proton collisions at square roots = 62-4 GeV (CCOR collaboration) [DOE/ER-02232/94] N81-20842
PROTOTYPES
Evaluation of a realtime prototype automatic target cuer N81-20823
PSYCHOACOUSTICS
Psychoacoustic evaluation of transmission line audible noise: Building attenuation effects, methodology comparison, and field study feasibility, volume 1 [DOE/RA-29323/1] N81-20833
PUBLIC HEALTH
Formulation and evaluation of new adhesives for highway use [PB81-129835] N81-20286
PULSARS
Time-dependent convection N81-20993
PULSE AMPLITUDE
High voltage, low inductance hydrogen thyratron study program [AD-A095278] N81-20364
PULSE CODE MODULATION
Digital filtering of PCM-recorded flight data for wind-processing N81-20009
PULSE RADAR
Minimum operational performance standards for airborne weather and ground mapping pulsed radars [RTCA/DO-173] N81-20323
Radar investigations of the Ross Ice Shelf N81-20631
PULSED RADIATION
A theoretical assessment of vibrational to rotational energy exchange in the hydrogen fluoride chemical laser N81-20413
PURIFICATION
Ultrapure metals preparation in space [NASA-CR-161678] N81-20101
Polynuclear aromatic compounds. Synthesis and purification [PB81-125015] N81-20182
Melt purification via filtration [AD-A095414] N81-20253
Production of ammonia in a packed-bed anaerobic upflow (ANFLOW) bioreactor [CONF-801104-10] N81-20294
PYROLYSIS
A theoretical investigation of the pyrolysis of solid fuels including condensation effects N81-20213
Flash pyrolysis and hydropyrolysis of coal [BNL-28577] N81-20301
Conversion of cellulosic wastes to liquid fuels [COO-2982-57] N81-20306
PYROTECHNICS
Safety and characterization tests on HIVELITE composition 300435 [AD-A095352] N81-20291
Evaluation of a pyrotechnic actuator concept by means of the probit statistical method. Justification of the choice of this method; application; examples of application [CNES-78/CT/PRT/SST/SE/72] N81-20310

Q

Q SWITCHED LASERS
Laser-initiated, reduced density channels for transporting charged particle beams [AD-A095725] N81-20415
QUALITY CONTROL
Evaluation of a pyrotechnic actuator concept by means of the probit statistical method. Justification of the choice of this method; application; examples of application [CNES-78/CT/PRT/SST/SE/72] N81-20310
Image restoration parameter choice: A quantitative guide [AD-A095708] N81-20446
Hybrid approaches and industrial applications of pattern recognition [AD-A095562] N81-20763
QUANTUM CHROMODYNAMICS
Quark and gluon decay functions in QCD and recombination model [DOE/ER-70004/266] N81-20845
QUANTUM MECHANICS
Action angle variables in classical and quantum mechanics --- a quantum analogue of classical Hamilton-Jacobi theory N81-20941
QUARKS
Quark and gluon decay functions in QCD and recombination model [DOE/ER-70004/266] N81-20845
QUENCHING (COOLING)
HC quench layer formation in combustion processes [DOE/ET-15303/T5] N81-20236
QUEUEING THEORY
Bounds on transmission delays for the CCRA --- Capetanakis collision resolution protocol [AD-A095658] N81-20346
Multiple finite source queueing model with fixed priority scheduling N81-20756
Distributed routing [AD-A095385] N81-20762

R

RABBITS
Morphological changes in neurons of the hind limb reflex arc during long term immobilization
[NASA-TM-75939] N81-20695

RADAR ANTENNAS
Molding of polypropylene film armor for radar antenna hardening applications
[AD-A095726] N81-20342

RADAR BEACONS
Minimum operational performance standards for airborne radar approach and beacon systems for helicopters
[RTCA/DO-172] N81-20322

RADAR CROSS SECTIONS
Electromagnetic scattering by open circular waveguides --- modeling jet engine inlets
[AD-A095554] N81-20345

RADAR ECHOES
A mathematical model for how ionospheric reflection degrades sea-echo spectra
[PB81-108359] N81-20652

RADAR EQUIPMENT
Minimum operational performance standards for airborne weather and ground mapping pulsed radars
[RTCA/DO-173] N81-20323
Shuttle orbiter Ku-band radar/communications system design evaluation
[NASA-CR-160898] N81-20327

RADAR IMAGERY
Principle and performance of radar sensors N81-20511

RADAR MAPS
Minimum operational performance standards for airborne weather and ground mapping pulsed radars
[RTCA/DO-173] N81-20323

RADAR MEASUREMENT
HF (High Frequency) radar measurements of circulation in the Eastern Strait of Juan de Fuca near Protection Island (July 1979)
[PB81-127490] N81-20690

RADAR RESOLUTION
Principle and performance of radar sensors N81-20511

RADAR SCANNING
Principle and performance of radar sensors N81-20511

RADAR TARGETS
Impact of system errors on TMR processing
[AD-A095382] N81-20348

RADAR TRACKING
The semi-operational evaluation of the trajectory prediction method for Signal Automatic Radar Processing (SARP) 2 --- air traffic control
[NLR-MP-79038-U] N81-20059
The reentry of SKYLAB: Reentry tracking and orbit calculation
[CNES-CT/EMT/MT/MS/208] N81-20143
Comparative tests between TIESPAD and SPA-66 radar display
[AD-A095643] N81-20340

RADARSCOPES
Comparative tests between TIESPAD and SPA-66 radar display
[AD-A095643] N81-20340

RADIAL FLOW
Analytical design of an advanced radial turbine --- automobile engines
[NASA-CR-165170] N81-20958

RADIANCE
Development of the Coastal Zone Color Scanner for NIMBUS 7. Volume 2: Test and performance data, revision A
[NASA-CR-166649] N81-20491

RADIANT FLUX DENSITY
ICAP: An Interactive Cluster Analysis Procedure for analyzing remotely sensed data --- to classify the radiance data to produce a thematic map
[NASA-TM-80732] N81-20494

RADIATION
Lidar observations at 0.7 micrometers and 10.6 micrometers wavelengths during Smoke Week 2
[AD-A095356] N81-20341

RADIATION ABSORPTION
A theoretical study of microwave beam absorption by a rectenna, introduction --- solar power satellites N81-20329
Evidence for self-focusing or filamentation from X-ray, 3/2 omega 0, and 2 omega 0 emission
[AD-A095450] N81-20416

RADIATION COUNTERS
Semiconductor devices as track detectors in high energy colliding beams experiments
[BNL-28850] N81-20861

RADIATION DOSAGE
Dimensions/NBS. Volume 64, no. 8, October 1980
[PB81-133654] N81-21007

RADIATION EFFECTS
Radiation effects in amorphous metallic alloys
[DOE/ET-10571/3] N81-20264
Nuclear survivability/vulnerability of aircrews: An experimental approach
[AD-A095501] N81-20729
The Roscoe Manual. Volume 2-1: Sample case --- nuclear explosion effects
[AD-A095535] N81-20742
Radiation effects in crystalline high-level nuclear waste solids
[PNL-SA-8732] N81-20858

RADIATION MEASUREMENT
Improved emission spectrographic facility
[DPSPU-80-30-7] N81-20228

RADIATION TRANSPORT
Scoring methods for implicit Monte Carlo radiation transport
[UCID-18858] N81-20852

RADIATIVE LIFETIME
Weak decays and charm searches
[COO-4831-3] N81-20846

RADIO ASTRONOMY
Radio Jupiter after Voyager: An overview of the Planetary Radio Astronomy observations
[NASA-TM-80718] N81-20988
Discovery of water vapor maser in the large Magellanic cloud
[INPE-1959-RPE/273] N81-20995
MM-wave and X-ray observastions of a Cen-A flare
[INPE-1958-RPE/272] N81-21005

RADIO COMMUNICATION
An update of nonstandard payload modulation restrictions N81-20162
Satellite-aided mobile radio concepts study: Concept definition of a satellite-aided mobile and personal radio communication system
[NASA-CR-166646] N81-20338

RADIO EMISSION
Radio Jupiter after Voyager: An overview of the Planetary Radio Astronomy observations
[NASA-TM-80718] N81-20988

RADIO FREQUENCIES
Tropospheric refractivity profiles inferred from RF measurements Passive Refractive Index by Satellite Monitoring (PRISM)
[AD-A095498] N81-20643

RADIO FREQUENCY DISCHARGE
Recent work on an RF ion thruster
[NASA-TM-81734] N81-20178

RADIO FREQUENCY HEATING
Ion heating in the ion cyclotron range of frequencies in the Wisconsin Tokapole 2 N81-20880
Drift-cyclotron loss-cone instability in the presence of the external wave fields N81-20885

RADIO TELEMETRY
The exchange of information between a satellite and the ground for control operations, and starting up the ground system N81-20132
The Deep Space Network: An instrument for radio science research
[NASA-CR-164077] N81-20339

RADIOACTIVE WASTES
Radioactive waste storage in mined caverns in crystalline rock: Results of field investigations at Stripa, Sweden
[LBL-11651] N81-20857
Radiation effects in crystalline high-level nuclear waste solids
[PNL-SA-8732] N81-20858

RADIOCHEMISTRY
Hot atom reactions involving multivalent and univalent species --- recoil (31)Si reactions
[DOE/ER-03898/52] N81-20854

RADIOGRAPHY
Objective appraisal of tolerance to ventriculography with various radiocontrast media (according to electronystagmography data)
[NASA-TM-76340] N81-20721

RADIOMETERS
LAPR: An experimental aircraft pushbroom scanner
[NASA-TM-80729] N81-20493

RADIOTELEPHONES
RACE: An automatic high frequency radio telephone system for communications in remote areas
[CRC-1338-E] N81-20326

RADOMES
Molding of polypropylene film armor for radar antenna hardening applications
[AD-A095726] N81-20342

RAIL TRANSPORTATION
Intercity, bus, rail, and air service for residents of rural areas
[PB81-120826] N81-20961

RAIN
Point process models of rainfall N81-20656

RAMAN SPECTRA
Raman spectra of highly conducting poly-p-phenylene complexes
[AD-A095660] N81-20218

RAMAN SPECTROSCOPY
Superstructure phonons and their characterization by Raman Spectroscopy --- zincblende and metal oxides N81-20929

RAMJET ENGINES
Aerodynamic characteristics of a hypersonic cruise aircraft concept with wing-mounted propulsion systems at Mach numbers of 2.96, 3.96 and 4.63 --- Langley unitary plan wind tunnel tests
[NASA-TM-81937] N81-20025

RANDOM ERRORS
Tolerence and perturbation analysis N81-20334

RANDOM NOISE
Statistics for peak values of multiple coherence
[AD-A095460] N81-20795

RANDOM VIBRATION
A response spectrum method for random vibrations
[PB81-122301] N81-20483

RANGE (EXTREMES)
Stability of VLF group velocity over long ranges N81-20321
Further development of new methods for estimating tail probabilities and extreme value distributions
[AD-A095721] N81-20794

RANGEFINDING
Position surveillance using one active ranging satellite and time-of-arrival of a signal from an independent satellite
[NASA-CR-166647] N81-20147
Accuracy of gravitational physics tests using ranges to the inner planets
[NASA-CR-164080] N81-20998

RANKING
Ranking various classifications of the same data from ground truths and contingency tables --- for the reduction of multispectral band scanner image data
[ESA-CR(P)-1388] N81-20766
Simple estimation procedures based on rank tests for the one- and two-sample location models N81-20791

RARE EARTH ALLOYS
Microstructure and properties of step aged rare Earth alloy magnets
[LBL-11680] N81-20938

RARE EARTH COMPOUNDS
Laser spectroscopy: Rare-earth crystals and crystals in solution N81-20913

RAREFIED GAS DYNAMICS
A quantitative Schlieren system for measuring radial density profiles of reduced density channels in gases
[AD-A095295] N81-20407

RATS
Changes in mast cells and in permeability of mesenteric microvessels under the effect of immobilization and electrostimulation
[NASA-TM-75988] N81-20694
Activity of certain enzymes in subcellular fractions of rat liver after flight on Cosmos 1129 biosatellite
[NASA-TM-76472] N81-20701

RAWINSONDES
Determination of regional evapotranspiration using energy balance, planetary boundary layer transfer coefficients and regularly recorded data N81-20626
RAYLEIGH WAVES
Reflection and transmission of obliquely incident Rayleigh waves at a vertical discontinuity N81-20629
Body and surface wave modeling of observed seismic events
[AD-A095690] N81-20645
RAYLEIGH-RITZ METHOD
Calculation of the room-temperature shapes of unsymmetric laminates
[NASA-CR-163993] N81-20184
RC CIRCUITS
Tantalum aluminum thin film technology for a new generation of microwave integrated circuit applications --- selective etching process control
[BMFT-FB-T-80-015] N81-20372
RDX
Analysis of RDX and HMX in PBX 9404 by high performance liquid chromatography
[MHSMP-80-55] N81-20307
REACTION KINETICS
Reactions of metal-metal multiple bonds. 8: Forming Mo-Mo quadruple bonds by reductive elimination (alkyl group disproportionation) in the reactions of 1,2-Mo2R2(NMe)4 compounds (M triple bond M) with carbon dioxide and 1,3-Diaryltriazenes
[AD-A095421] N81-20224
Ultraviolet laser photochemistry of halogenated methanes
[LA-UR-80-2798] N81-20233
Reaction rates of atmospheric gases with Lithium (Silicon) alloy
[SAND-80-1363] N81-20234
Kinetics of the degradation of type 316 stainless steel by liquid lithium N81-20239
Kinetics of hydrogen absorption-desorption by metals
[BNL-28584] N81-20259
Transient boundary-layer flows in combustion environments
[UCRL-84519] N81-20401
New formulation of backward differenced linear multistep methods for ordinary differential equations
[UCID-18825] N81-20779
The application of nuclear techniques to solid state devices
[AD-A095251] N81-20933
REACTION TIME
The effect of oxygen and anthraquinone on the alkaline depolymerization of amylose N81-20272
Nuclear survivability/vulnerability of aircrews: An experimental approach
[AD-A095501] N81-20729
REACTION WHEELS
Actuators --- for spacecraft applications N81-20121
Magnetic bearing reaction wheel tests --- satellite applications
[CNES-80/CT/PRT/SST/SS/162] N81-20444
REACTOR DESIGN
Commerical tandem mirror reactor design with thermal barriers: WITAMIR-I
[UWFDM-375] N81-20887
Mirror fusion test facility magnet system
[UCRL-52955] N81-20904
REACTOR MATERIALS
Category 1 structures: Safety margin at ultimate load
[LA-UR-80-2858] N81-20472
REACTOR STARTUP TESTS
Approach to ignition of Tokamak reactors
[ORNL/TM-7552] N81-20897
REAL TIME OPERATION
Possible online uses of AIDS data in future ATC systems N81-20018
Study of a real-time X-Y addressable spatial filter --- for onboard satellite optical data processing
[CD-6500621/3] N81-20154
Phase control during reconstruction of holographically recorded flow fields using real-time holographic interferometry
[NASA-TM-81953] N81-20405
Real-time grey-level histogram manipulation N81-20807
Image enhancement in real time N81-20813
A system look at real time processing for target acquisition and classification N81-20825
RECEIVERS
Adaptive spread spectrum receiver using acoustic surface wave technology
[AD-A095737] N81-20347
RECEPTION DIVERSITY
Diversity techniques for omnidirectional telementry coverage of the HiMAT research vehicle
[NASA-TP-1830] N81-20074
RECLAMATION
Summary of the western energy overhead monitoring project
[PB81-129009] N81-20531
RECOIL ATOMS
Hot atom reactions involving multivalent and univalent species --- recoil (31)Si reactions
[DOE/ER-03898/52] N81-20854
RECOMBINATION COEFFICIENT
Theoretical studies of highly ionized species
[DOE/ER-02887/2] N81-20850
RECOMBINATION REACTIONS
Quark and gluon decay functions in QCD and recombination model
[DOE/ER-70004/266] N81-20845
RECONNAISSANCE SPACECRAFT
LORI: A multisatellite, multisystem, time-coverage analysis program
[AD-A095537] N81-20148
RECORDING INSTRUMENTS
Experiences with flight recorders obtained by analyzing aircraft accidents N81-20019
RECREATION
Water resource priorities for the midwest --- Ohio, Indiana, Illinois, Michigan, Minnesota, Wisconsin, and Iowa
[PB81-129801] N81-20315
RECRYSTALLIZATION
The petrology and geochemistry of the Baltimore Mafic Complex, Maryland N81-20627
RECTANGULAR PANELS
The effects of repair patches on the stress distribution in a cracked sheet --- models of rectangular and square patches
[RAE-TR-80098] N81-20480
RECTANGULAR PLATES
Buckling of a rectangular plate on an elastic foundation, compressed in two directions N81-20457
RECTENNAS
A theoretical study of microwave beam absorption by a rectenna
[NASA-CR-160921] N81-20328
A theoretical study of microwave beam absorption by a rectenna, introduction --- solar power satellites N81-20329
Current sheet model N81-20331
Waveguide model N81-20332
Grating lobes N81-20333
Tolerence and perturbation analysis N81-20334
REDUCTION (CHEMISTRY)
Reactions of metal-metal multiple bonds. 8: Forming Mo-Mo quadruple bonds by reductive elimination (alkyl group disproportionation) in the reactions of 1,2-Mo2R2(NMe)4 compounds (M triple bond M) with carbon dioxide and 1,3-Diaryltriazenes
[AD-A095421] N81-20224
Preparation of high purity vanadium
[IS-M-305] N81-20262
REENTRY TRAJECTORIES
Space vehicle atmospheric reentry trajectories N81-20140
REFLECTANCE
The development and evaluation of an automated reflectance microscope system for the petrographic characterization of bituminous coals N81-20488
New observations on the daily variations of natural ice albedo
[PB81-132789] N81-20532
REFLECTOMETERS
D-region electron density measurements obtained by partial reflection techniques
[AD-A095566] N81-20644
REFRACTORY MATERIALS
Investigations on processing and properties of high-temperature silicon carbide materials
[BMFT-FB-T-79-170] N81-20282
Investigation of fabrication, composition and properties of new high temperature ceramics based on silicon nitride
[BMFT-FB-T-79-174] N81-20283
REGRESSION ANALYSIS
Classification of petroleum samples from gas chromatographic data by pattern recognition techniques and simulation of mass spectra by regression analysis of structural descriptors N81-20202
REINFORCEMENT (STRUCTURES)
The effects of repair patches on the stress distribution in a cracked sheet --- models of rectangular and square patches
[RAE-TR-80098] N81-20480
RELATIVITY
A spin coefficient approach to Weyssenhoff fluids in Einstein-Cartan theory
[MATH-RES-153] N81-20801
Ghost neutrinos in Einstein-Cartan theory --- a Newman-Penrose type formalism
[MATH-RES-146] N81-20945
A Newman-Penrose type formalism for space-times with torsion. Part 3: Neutrino fields in Einstein-Cartan theory
[MATH-RES-147-PT-3] N81-20946
Accuracy of gravitational physics tests using ranges to the inner planets
[NASA-CR-164080] N81-20998
RELAXATION (MECHANICS)
Transient analysis of vibrations in nonideal multilayered piezoelectric devices
[SAND-80-1909] N81-20937
RELAXATION (PHYSIOLOGY)
The viscoelastic behavior of the human intervertebral disc N81-20705
Study on contraction and relaxation of experimentally denervated and immobilized muscles: Comparison with dystrophic muscles
[NASA-TM-76053] N81-20724
RELIABILITY
Optimal risk-based design of water resource engineering projects
[PB81-136202] N81-20316
Results on the performance of a broad hand focusing Cherenkov counter
[COO-3072-119] N81-20410
RELIABILITY ANALYSIS
Integrating reliability analysis and design
[ALO-131] N81-20449
Bayesian optimal designs for surveillance procedures in attribute life testing
[AD-A095723] N81-20796
RELIABILITY ENGINEERING
Evaluation of a pyrotechnic actuator concept by means of the probit statistical method. Justification of the choice of this method; application; examples of application
[CNES-78/CT/PRT/SST/SE/72] N81-20310
On the optimal maintenance of reliability systems N81-20445
Integrating reliability analysis and design
[ALO-131] N81-20449
Development of components for optical communications with light guiding fibers
[BMFT-FB-T-80-006] N81-20874
RELIEF MAPS
Analog rectification --- transformation of a council perspective (remote sensor imagery) into an orthogonal cylindrical perspective (map) N81-20516
REMOTE SENSING
Study on the compatibility of SURSAT and LASS/COMSS technical mission requirements --- satellite ground tracks
[CAL-79/91-1] N81-20104
Earth Resources: A continuing bibliography, issue 28
[NASA-SP-7041(28)] N81-20486
Identification of irrigation practices using photographic and optical-mechanical scanning remote sensing techniques N81-20487
Digital processing of remotely sensed images
[NASA-SP-431] N81-20489
A look at remote sensing of the ocean temperature structure
[AD-A095644] N81-20524
Summary of the western energy overhead monitoring project
[PB81-129009] N81-20531

Coastal remote sensing investigations. Volume 2: Beach environment
[AD-A095692] N81-20688

REMOTE SENSORS
Strapdown inertial optical system (SIOS) --- for observation and communication satellites
[REPT-0002/DX60] N81-20153

REMOTELY PILOTED VEHICLES
Diversity techniques for omnidirectional telementry coverage of the HiMAT research vehicle
[NASA-TP-1830] N81-20074

RESCUE OPERATIONS
Evaluation of national SAR manual: Probability of detection curves
[AD-A095748] N81-20048
SARSAT: A rescue system for ships and airplanes
[NASA-TM-76391] N81-20103

RESEARCH
The Deep Space Network: An instrument for radio science research
[NASA-CR-164077] N81-20339
Applied research in analytical photogrammetry
[PB81-127300] N81-20530
Radiation effects in crystalline high-level nuclear waste solids
[PNL-SA-8732] N81-20858

RESEARCH AIRCRAFT
Recent progress in V/STOL aircraft technology
[NASA-TM-81281] N81-20066

RESEARCH AND DEVELOPMENT
Experimental development of bladings for large steam turbines N81-20433
The 1981 Budget of the German Federal Ministry for Research and Technology
[NASA-TM-76493] N81-20956

RESEARCH FACILITIES
The SPOT satellite image processing facility in Toulouse and its capabilities N81-20520
Programs, projects, and headaches --- NASA central program management and the field centers N81-20976
Jet Propulsion Laboratory: Outsider or insider? N81-20977

RESEARCH MANAGEMENT
Fundamental understanding of matter: An engineering viewpoint
[LA-UR-80-3585] N81-20181
Coordination and management tasks for the IEA solar heating and cooling program and CCMS solar energy pilot study
[DOE/CS-30108/T3] N81-20567
The rocket and satellites research panel: The first space scientists N81-20966
The Academy of Sciences stakes a claim N81-20967
Who decides? --- program proposals; relations between NASA and the scientific community N81-20974
The universities: Allies and rivals to NASA N81-20975
Programs, projects, and headaches --- NASA central program management and the field centers N81-20976

RESIDENTIAL ENERGY
A reference building approach to building energy performance standards for single-family residences
[PB81-135642] N81-20318
Energy conservation in houses built from 1960
[SIB-R-4-1980] N81-20569
Residential solar data center MIRADS user's guide
[PB81-132268] N81-20606

RESIDUAL STRESS
Determination of load sequence effects on the degradation and failure of composite materials --- Graphite-epoxy composites
[NASA-CR-164065] N81-20186

RESIDUES
Physical and chemical characteristics of Mt. St. Helens airborne debris
[LA-UR-81-110] N81-20613

RESIN MATRIX COMPOSITES
Static test of a wing box structure made of composite materials, phase 1
[FFA-TN-HU-2127] N81-20481

RESINS
Comparative adsorption performance of synthetic absorbents and activated carbons N81-20215

RESONANCE
Analyses of the US Navy orbits of 1963-24B and 1974-34A at 15th order resonance
[RAE-TR-80093] N81-20142

RESONANCE SCATTERING
Density measurement in air with a saturable absorbing seed gas
[NASA-CR-164063] N81-20641

RESONANT VIBRATION
Total main rotor isolation system analysis
[NASA-CR-165666] N81-20027
Blade vibration excitation and sound generation by flow nonuniformities N81-20429

RESOURCE ALLOCATION
Basin development and water allocation
[PB81-127276] N81-20534

RESOURCES
Water resource priorities for the midwest --- Ohio, Indiana, Illinois, Michigan, Minnesota, Wisconsin, and Iowa
[PB81-129801] N81-20315
Wind energy resource atlas. Volume 4: The Northeast region
[PNL-3195-WERA-4] N81-20592

RESOURCES MANAGEMENT
Indiana five-year water resources research and development plan. Fiscal years 1982 - 1986 --- hydrologic setting and water resource utilization
[PB81-121253] N81-20621

RESPONSES
Response of selected microorganisms to experimental planetary environments
[NASA-CR-164064] N81-20733

RESTORATION
Image restoration parameter choice: A quantitative guide
[AD-A095708] N81-20446

RETROFITTING
Retrofit and verification test of a 30-cm ion thruster
[NASA-CR-165233] N81-20174

RETROREFLECTION
Statistical properties of visible and infrared beams retroreflected through a turbulent atmosphere
[LA-UR-80-3674] N81-20872

RETURN BEAM VIDICONS
Photographic cameras and return beam vidicons --- functioning onboard spacecraft N81-20507

REVERSE FIELD PINCH
Axial shock wave heating of reversed-field theta-pinch plasmas
[MSNW-81-1158-1] N81-20908

REVERSE OSMOSIS
Technical and economic feasibility of membrane technology
[DOE/CS-40213/T1] N81-20231

RHODIUM
The high resolution imaging atom-probe with application to nickel platings
[AD-A095254] N81-20251

RISK
Optimal risk-based design of water resource engineering projects
[PB81-136202] N81-20316

RIT ENGINES
Recent work on an RF ion thruster
[NASA-TM-81734] N81-20178

RIVER BASINS
Green River Basin flow forecasting models
[PB81-124448] N81-20529
Point process models of rainfall N81-20656

ROADS
Formulation and evaluation of new adhesives for highway use
[PB81-129835] N81-20286

ROBUSTNESS (MATHEMATICS)
A Monte Carlo comparison of robust and resistant estimators of bivariate correlation N81-20785
Aspects of efficiency robust estimation of location N81-20787

ROCKET ENGINE DESIGN
Retrofit and verification test of a 30-cm ion thruster
[NASA-CR-165233] N81-20174

ROCKET ENGINES
Extended operating range of the 30-cm ion thruster with simplified power processor requirements
[NASA-TM-81729] N81-20179

ROCKET FLIGHT
Prophets and pioneers of spaceflight N81-20965
The rocket and satellites research panel: The first space scientists N81-20966

ROCKET THRUST
Spacecraft launching --- launch vehicle considerations N81-20123

ROCKET VEHICLES
Rockets and spacecraft: Sine qua non of space science N81-20972

ROCKET-BORNE INSTRUMENTS
Magnetospheric sounding rocket program: The magnetometer experiment in the substorm phenomena payload
[BMFT-FB-W-79-34] N81-20649

ROCKS
Groundwater heat pumps: An examination of hydrogeologic, environmental, legal, and economic factors affecting their use. Volume 2: Appendix D, state hydrogeologic descriptions and maps
[DOE/CS-20060/5120-VOL-2] N81-20398
Performance of air collector house heating systems with rock bed storage --- solar heating N81-20553
The petrology and geochemistry of the Baltimore Mafic Complex, Maryland N81-20627
The composition of the Martian dark regions: Observations and analysis
[NASA-CR-164072] N81-20999

ROLL
The influence of roll orientation-dependent aerodynamics on the stability of cruciform missile configurations
[AD-A095269] N81-20151

ROLL FORMING
Graphite composite truss welding and cap section forming subsystems. Volume 2: Program results
[NASA-CR-160932] N81-20483

ROLLER BEARINGS
Life analysis of multiroller planetary traction drive
[NASA-TP-1710] N81-20423
High speed cylindrical roller bearing development
[AD-A095357] N81-20437

ROLLING MOMENTS
Leading-edge separation from a slender rolling wing-body combination --- vortex sheet model
[RAE-TR-80039] N81-20040
The prediction of normal force and rolling moment coefficients for a spinning wing
[NASA-CR-165680] N81-20068

ROSS ICE SHELF
Radar investigations of the Ross Ice Shelf N81-20631

ROTARY WINGS
An extension of the local momentum theory to a distorted wake model of a hovering rotor
[NASA-TM-81258] N81-20030
The elaboration of a new family of helicopter blade profiles
[NASA-TM-75907] N81-20031

ROTATING BODIES
Total main rotor isolation system analysis
[NASA-CR-165666] N81-20027

ROTATING DISKS
Turbine materials characteristics under low cycle fatigue --- turbine engine disk life
[BMFT-FB-T-79-151] N81-20268

ROTATING FLUIDS
An investigation of Tkachenko waves in rotating He2 N81-20916

ROTOR AERODYNAMICS
Total main rotor isolation system analysis
[NASA-CR-165666] N81-20027

ROTOR BLADES (TURBOMACHINERY)
Large wind energy converter: Growian 3 MW
[NASA-TM-75404] N81-20543

RUBBER
Permeation of protective garment material by liquid halogenated ethanes and a polychlorinated biphenyl
[LA-8572-MS] N81-20732

RUBIDIUM
The electrical resistivity and the thermoelectric ratio of potassium and dilute potassium rubidium alloys below 1 K N81-20919

RURAL AREAS
Intercity, bus, rail, and air service for residents of rural areas
[PB81-120826] N81-20961

S

SAFETY
Carbon/graphite composite material study
[NASA-CR-164084] N81-20189
SAFETY FACTORS
Improved emission spectrographic facility
[DPSPU-80-30-7] N81-20228
SAFETY MANAGEMENT
Dimensions/NBS. Volume 64, no. 8, October 1980
[PB81-133654] N81-21007
SAMPLES
Elemental distributions of biological materials by ion microscopy N81-20211
SAMPLING
Classification of petroleum samples from gas chromatographic data by pattern recognition techniques and simulation of mass spectra by regression analysis of structural descriptors N81-20202
Contributions to survey sampling and design of experiments N81-20790
SANDS
Coastal remote sensing investigations. Volume 2: Beach environment
[AD-A095692] N81-20688
SARSAT
SARSAT: A rescue system for ships and airplanes
[NASA-TM-76391] N81-20103
SATELLITE ANTENNAS
Satellite-aided mobile radio concepts study: Concept definition of a satellite-aided mobile and personal radio communication system
[NASA-CR-166646] N81-20338
SATELLITE ATTITUDE CONTROL
Generalities and definition of a system --- for command and control of satellite attitude and orbit N81-20118
Attitude and orbit command --- guidance with spin stabilization or three axis stabilization N81-20119
Actuators --- for spacecraft applications N81-20121
Attitude determination --- for orbiting spacecraft N81-20122
Space missions and orbit/attitude systems N81-20126
The exchange of information between a satellite and the ground for control operations, and starting up the ground system N81-20132
Strapdown inertial optical system (SIOS) --- for observation and communication satellites
[REPT-0002/DX60] N81-20153
Magnetic bearing reaction wheel tests --- satellite applications
[CNES-80/CT/PRT/SST/SS/162] N81-20444
Earth observation satellite attitude --- principal perturbations and control techniques N81-20503
Study of interaction between solar arrays and attitude - orbit control. Volume 1: Technical Report
[ESS/SS-987-VOL-1] N81-20603
SATELLITE DRAG
Orbit perturbation: Causes and representation N81-20112
Models of the upper Earth atmosphere. Application to satellite trajectory determination N81-20139
SATELLITE GROUND SUPPORT
The exchange of information between a satellite and the ground for control operations, and starting up the ground system N81-20132
Ground equipment for moving satellites and geostationary satellites --- used in the ground support function N81-20133
Radiometric degradation of images and ground preprocessing --- of imagery received from remote sensors N81-20513
Overview of the SPOT mission and description of the ground segment N81-20519
SATELLITE GROUND TRACKS
Study on the compatibility of SURSAT and LASS/COMSS technical mission requirements --- satellite ground tracks
[CAL-79/91-1] N81-20104
SATELLITE OBSERVATION
Study on the compatibility of SURSAT and LASS/COMSS technical mission requirements --- satellite ground tracks
[CAL-79/91-1] N81-20104
Methods of localization by satellites in the ARGOS system N81-20134
Earth Resources: A continuing bibliography, issue 28
[NASA-SP-7041(28)] N81-20486
Geometrical quality of scanning sensor imagery --- from earth satellites N81-20501
On the orbits used for Earth observation missions --- their parametrization and calculation N81-20502
Satellite limitations compared to mission requirements for Earth observation N81-20512
The equatorial latitude of auroral activity 1972 - 1977 --- dmsp satellite observation
[PB81-132912] N81-20654
Deepening perspective: A new look at the old world --- satellites and the earth sciences N81-20973
SATELLITE ORBITS
SARSAT: A rescue system for ships and airplanes
[NASA-TM-76391] N81-20103
Space vehicle orbital motion --- conferences
[ISSN-0244-8041] N81-20108
Basic notions in rational mechanics and applications to space mechanics N81-20109
Orbit perturbations: The effects --- elliptical orbits N81-20113
Extrapolation of orbits N81-20114
Orbit determination: Statistical methods N81-20116
Orbit calculation programs --- choice of hardware and implementation in function of mission requirements N81-20117
A scanning satellite. Maintaining the orbit. SPOT N81-20130
Choice and acquisition of the SPOT satellite orbit N81-20131
Analyses of the US Navy orbits of 1963-24B and 1974-34A at 15th order resonance
[RAE-TR-80093] N81-20142
SATELLITE ORIENTATION
Principles and sensors for attitude measurement --- satellite applications N81-20120
Attitude determination --- for orbiting spacecraft N81-20122
Space missions and orbit/attitude systems N81-20126
Earth observation satellite attitude --- principal perturbations and control techniques N81-20503
SATELLITE PERTURBATION
A scanning satellite. Maintaining the orbit. SPOT N81-20130
Dynamic spatial geodesy --- to determine the Earth's gravitational field by satellite trajectory analysis N81-20499
Earth observation satellite attitude --- principal perturbations and control techniques N81-20503
SATELLITE POWER TRANSMISSION (TO EARTH)
Satellite Power System (SPS) utility integration: Institutional, planning and operational issues
[EAC-R-4015] N81-20596
Environmental assessment for the satellite power system concept development and evaluation program. Atmosphere effects
[DOE/ER-0090] N81-20598
SATELLITE ROTATION
Generalities and definition of a system --- for command and control of satellite attitude and orbit N81-20118
SATELLITE SOLAR ENERGY CONVERSION
Analysis of costs of gallium arsenide and silicon solar arrays for space power applications
[NASA-TP-1811] N81-20173
Satellite Power Systems (SPS) concept definition study (Exhibit D). Volume 6, part 1: Cost and Programmatics
[NASA-CR-3397] N81-20537
SATELLITE TELEVISION
Subjective evaluation of FM/FM protection radio for television broadcasting by satellite, appendices
[CRC-1340] N81-20325
SATELLITE TRACKING
Measurement for orbit determination --- comparison of ground based satellite position observation techniques N81-20115
Natural reentry of satellites: SKYLAB --- orbit calculations N81-20141
SATELLITE-BORNE INSTRUMENTS
Principles and sensors for attitude measurement --- satellite applications N81-20120
Study of a real-time X-Y addressable spatial filter --- for onboard satellite optical data processing
[CD-6500621/3] N81-20154
Design, fabrication and testing of a satellite electron beam system
[AD-A095362] N81-20362
SATELLITE-BORNE PHOTOGRAPHY
Spaceborne cartography of the Earth --- conference; Toulouse, 5-19 Jun. 1979 N81-20496
Performance of the discrete Fourier Transform satellite imagery classification technique
[AD-A095364] N81-20670
SATELLITES
The rocket and satellites research panel: The first space scientists N81-20966
The Academy of Sciences stakes a claim N81-20967
SATURN (PLANET)
Far-ultraviolet spectral and spatial imaging of Jupiter and Saturn N81-20987
SCANNERS
LAPR: An experimental aircraft pushbroom scanner
[NASA-TM-80729] N81-20493
Spaceborne scanners for photoelectric detection N81-20508
SCATHA SATELLITE
Design, fabrication and testing of a satellite electron beam system
[AD-A095362] N81-20362
SCATTERING CROSS SECTIONS
Weak decays and charm searches
[COO-4831-3] N81-20846
Scoring methods for implicit Monte Carlo radiation transport
[UCID-18858] N81-20852
Charged-particle cross section data for fusion plasma applications
[COO-2218-195] N81-20902
SCENE ANALYSIS
Principles of photogrammetry --- the geometry of scene identification and analysis N81-20504
Apparatus for reconstruction --- of photogrammetric data; operational specifications N81-20505
SCHEDULING
Multiple finite source queueing model with fixed priority scheduling N81-20756
SCHLIEREN PHOTOGRAPHY
The influence of turbulence on combustion in open pre-mixed flames N81-20198
A quantitative Schlieren system for measuring radial density profiles of reduced density channels in gases
[AD-A095295] N81-20407
Quantitative schlieren analysis of acoustic interaction with submerged plates N81-20828
SCHOTTKY DIODES
The 31.4 GHz parametric amplifier
[NASA-CR-166643] N81-20360
SCIENTISTS
Limitless Horizons. Careers in Aerospace
[NASA-EP-171] N81-20947
The rocket and satellites research panel: The first space scientists N81-20966
SEA STATES
A mathematical model for how ionospheric reflection degrades sea-echo spectra
[PB81-108359] N81-20652
Satellite altimetric measurements of the ocean. Report of the TOPEX Science Working Group
[NASA-CR-164087] N81-20686
SEA WATER
The photochemical transformations of organic compounds in seawater N81-20200
Critical evaluation of the radiometric requirements of satellite onboard equipment for the measurement of ocean color
[ESA-CR(P)-1390] N81-20526
SEALING
Alternate protection concepts for second surface silver/glass solar mirrors
[PNL-3629] N81-20578
SEARCHING
Evaluation of national SAR manual: Probability of detection curves
[AD-A095748] N81-20048
SARSAT: A rescue system for ships and airplanes
[NASA-TM-76391] N81-20103
SEASAT SATELLITES
Research of the state of convection in the Earth's mantle
[NASA-CR-163989] N81-20639

SECURITY
Passenger value structure model: Automated Guideway Transit Technology program
[PB81-120875] N81-20960
SEDIMENTS
Development of the Coastal Zone Color Scanner for NIMBUS 7. Volume 2: Test and performance data, revision A
[NASA-CR-166649] N81-20491
A trophic classification of Minnesota lakes based on lake sediments
[PB81-124141] N81-20535
SEISMIC WAVES
International seismological data center: Procedures to check events through dynamic information and to estimate magnitudes --- monitoring for the nuclear test ban treaty
[FOA-C-20366-T1] N81-20648
SEISMOLOGY
Reflection and transmission of obliquely incident Rayleigh waves at a vertical discontinuity N81-20629
Body and surface wave modeling of observed seismic events
[AD-A095690] N81-20645
SELECTIVITY
Tantalum aluminum thin film technology for a new generation of microwave integrated circuit applications --- selective etching process control
[BMFT-FB-T-80-015] N81-20372
SELF EXCITATION
Blade vibration excitation and sound generation by flow nonuniformities N81-20429
SELF FOCUSING
Evidence for self-focusing or filamentation from X-ray, 3/2 omega 0, and 2 omega 0 emission
[AD-A095450] N81-20416
SEMANTICS
On bounds for the specification of finite data types by means of equations and conditional equations --- algebraic data types
[MC-IW-131/80] N81-20781
SEMICONDUCTOR DEVICES
Microelectronics availability for the Army's missiles
[AD-A095379] N81-20152
Controlled avalanche transit-time triode amplifiers N81-20353
Semiconductor devices as track detectors in high energy colliding beams experiments
[BNL-28850] N81-20861
Semiconductor devices for optical communications in 1 micron band of wavelength --- gallium indium arsenide phosphide lasers and diodes
[NASA-TM-75869] N81-20867
SEMICONDUCTOR LASERS
Optical gain in semiconductor lasers
[BMFT-FB-T-79-167] N81-20422
SEMICONDUCTORS (MATERIALS)
Electronic properties associated with donor impurities in multivalley semiconductors --- silicon, germanium and gallium phosphites N81-20917
SENSORY PERCEPTION
Characteristics of vestibulosensory reactions studied by experimental caloric test
[NASA-TM-76386] N81-20718
SEPARATED FLOW
Leading-edge separation from a slender rolling wing-body combination --- vortex sheet model
[RAE-TR-80039] N81-20040
Measurements of a separating turbulent boundary layer
[AD-A095252] N81-20394
Measurements of the transverse velocity of a separating turbulent boundary layer --- wind tunnel tests
[AD-A095256] N81-20395
SEPARATORS
Improvement of the electrolytic process of hydrogen production
[EUR-6764-FR] N81-20299
Coal preparation using magnetic separation. Volume 5: Evaluation of magnetic coal desulfurization concepts
[EPRI-CS-1517-VOL-5] N81-20302
SEQUENTIAL ANALYSIS
Aspects of symmetric Bayesian sequential decision problems N81-20789
SERIES (MATHEMATICS)
Functional series identification of nonlinear systems for adaptive control N81-20758
SERIES EXPANSION
An asymptotic expansion for the distribution of the location linear discriminant function
[MATH-RES-149] N81-20784
SERVICE LIFE
Concept definition: Retirement for cause of F-100 rotor components
[AD-A095584] N81-20080
Naval structural materials: Requirements, issues, and opportunities
[AD-A095724] N81-20466
Bayesian optimal designs for surveillance procedures in attribute life testing
[AD-A095723] N81-20796
SHALE OIL
The development of synthetic fuels: Department of Defense logistics implications
[AD-A095713] N81-20290
SHAPES
Calculation of the room-temperature shapes of unsymmetric laminates
[NASA-CR-163993] N81-20184
SHEAR LAYERS
The velocity induced by the wake of a wind turbine in a shear layer, including ground effect
[FFA-133] N81-20037
SHEAR PROPERTIES
Experimental and theoretical investigations on the influence of shear in double diffusive convection N81-20376
SHEAR STRESS
Measurements of a separating turbulent boundary layer
[AD-A095252] N81-20394
Critically loaded hole technology pilot collaborative test programme
[AGARD-R-678] N81-20461
SHEDDING
A feasibility study of an instrument for measuring wind speed employing vortex shedding
[BU-254] N81-20411
SHELL THEORY
Atomic inner-shell processes
[AD-A095415] N81-20837
SHIPS
Position surveillance using one active ranging satellite and time-of-arrival of a signal from an independent satellite
[NASA-CR-166647] N81-20147
Naval structural materials: Requirements, issues, and opportunities
[AD-A095724] N81-20466
SHOCK HEATING
Axial shock wave heating of reversed-field theta-pinch plasmas
[MSNW-81-1158-1] N81-20908
SHOCK LOADS
A panel method to determine loads on oscillating airfoils in transonic flow with embedded shock waves
[NLR-MP-80005-U] N81-20039
SHOCK TESTS
Test and evaluation of foam-in-place fuel tank container
[AD-A095747] N81-20073
SHOCK WAVES
A panel method to determine loads on oscillating airfoils in transonic flow with embedded shock waves
[NLR-MP-80005-U] N81-20039
Numerical calculation of shock-induced initiation of detonations
[LA-UR-80-2854] N81-20303
Evidence for fault asperities from systematic time-domain modeling of teleseimic waveforms N81-20630
Theoretical studies of highly ionized species
[DOE/ER-02887/2] N81-20850
On the complex state of the interplanetary medium of 28-29 July 1977
[NASA-TM-82095] N81-20996
SHORT HAUL AIRCRAFT
Recent progress in V/STOL aircraft technology
[NASA-TM-81281] N81-20066
SHORT TAKEOFF AIRCRAFT
Design of a fuel-efficient guidance system for a STOL aircraft
[NASA-TM-81256] N81-20006
SIGNAL DETECTION
Statistics for peak values of multiple coherence
[AD-A095460] N81-20795
SIGNAL MIXING
Nonlinear optical phase conjugation by 3-wave and 4-wave mixing N81-20862
SIGNAL PROCESSING
Shuttle/payload communications and data systems interface analysis: Executive summary
[NASA-CR-160929] N81-20158
Shuttle/payload communications and data systems interface analysis: Introduction N81-20159
Payload/orbiter signal processing and data handling system evaluation presentation N81-20160
Preliminary interface revision notice SD-152C update of section 8.3 of ICD 2-19001 for detached payloads N81-20163
The effect of interference on delta modulation encoded video signals
[NASA-CR-160923] N81-20324
Impact of system errors on TMR processing
[AD-A095382] N81-20348
Hardware implementations of Fourier Transform signal processing
[PB81-123200] N81-20351
Applications of CCD and SAW devices to image processing N81-20357
Information content of LDA-signals and operations of LDA-signal processors --- measurement of flow properties N81-20387
A real-time video tracking system based on Bayes rule N81-20819
SIGNAL RECEPTION
Automatic gain control --- the Loran-C receiver
[NASA-CR-164082] N81-20053
SIGNAL TO NOISE RATIOS
Subjective evaluation of FM/FM protection ratio for television broadcasting by satellite, appendices
[CRC-1340] N81-20325
SIGNAL TRANSMISSION
Shuttle/payload communications and data systems interface analysis
[NASA-CR-160929] N81-20157
An update of nonstandard payload modulation restrictions N81-20162
SIGNATURE ANALYSIS
Aircraft program for target, background, and sky radiance measurements
[AD-A095363] N81-20646
SILICA GEL
A chromatographic and spectroscopic characterization of chemically bonded stationary phases N81-20195
SILICA GLASS
SPAR 6 experiment report containerless processing of glass experiment 74-42
[NASA-CR-161674] N81-20102
SILICON
Analysis of costs of gallium arsenide and silicon solar arrays for space power applications
[NASA-TP-1811] N81-20173
Extrinsic specific heat of phosphorus doped silicon
[INPE-1942-RPE/261] N81-20216
SILICON ALLOYS
Reaction rates of atmospheric gases with Lithium (Silicon) alloy
[SAND-80-1363] N81-20234
The retardation of crystallization of CVD amorphous silicon and the study of its structural and optical properties N81-20912
SILICON CARBIDES
Platelet mechanism of erosion of ductile metals
[LBL-11341-REV] N81-20261
Investigations on processing and properties of high-temperature silicon carbide materials
[BMFT-FB-T-79-170] N81-20282
High temperature properties of different SiC materials: Creep behavior
[BMFT-FB-T-79-157] N81-20478
SILICON COMPOUNDS
The application of nuclear techniques to solid state devices
[AD-A095251] N81-20933
SILICON DIOXIDE
A chromatographic and spectroscopic characterization of chemically bonded stationary phases N81-20195
SILICON ISOTOPES
Hot atom reactions involving multivalent and univalent species --- recoil (31)Si reactions
[DOE/ER-03898/52] N81-20854

SILICON NITRIDES
Investigation of fabrication, composition and properties of new high temperature ceramics based on silicon nitride
[BMFT-FB-T-79-174] N81-20283
Dry lubrication of high temperature silicon nitride rolling contacts
[AD-A095202] N81-20435
SILICON TRANSISTORS
Crystal defects in large scale integrated circuits of silicon --- and implications for crystal growth process control
[BMFT-FB-T-79-156] N81-20369
SILICONES
Selected physical and thermal properties of various formulations of silicone potting compounds
[MHSMP-80-63] N81-20235
SILVER
Adhesion and chemical vapor testing of second surface silver/glass solar mirrors
[PNL-3575] N81-20577
Alternate protection concepts for second surface silver/glass solar mirrors
[PNL-3629] N81-20578
Structural and thermodynamic properties of xenon, krypton, and argon adsorbed on silver(111) N81-20924
SIMILARITY THEOREM
Diabatic wind profile and its relation to the scale of turbulence
[INPE-1966-RPE/277] N81-20661
SIMULATION
Basin development and water allocation
[PB81-127276] N81-20534
SINGLE CRYSTALS
Effects of hydrogen on the elastic constants of vanadium and palladium single crystals N81-20242
The role of positional disorder in ferroelectric relaxors N81-20923
A feasibility study on the growth of bulk GaN single crystals
[AD-A095567] N81-20931
A feasibility study on the growth of bulk GaN single crystals
[AD-A095553] N81-20932
SINTERING
Conductivity as a tool for evaluating the homogeneity of sintered discs of transition metal oxides
[AD-A095298] N81-20249
Silver-iron batteries
[STU-78-4981] N81-20597
SITE SELECTION
Comparative assessment of five potential sites for hydrothermal-magma systems: Summary
[DOE/TIC-11303] N81-20525
October 1980 environmental data for sites in the National Solar Data Network
[SOLAR/0010-80/10] N81-20588
SKY RADIATION
Aircraft program for target, background, and sky radiance measurements
[AD-A095363] N81-20646
SKYLAB PROGRAM
Natural reentry of satellites: SKYLAB --- orbit calculations N81-20141
The reentry of SKYLAB: Reentry tracking and orbit calculation
[CNES-CT/EMT/MT/MS/208] N81-20143
SLENDER BODIES
Leading-edge separation from a slender rolling wing-body combination --- vortex sheet model
[RAE-TR-80039] N81-20040
SLENDER WINGS
Leading edge devices on slender wings --- wind tunnel tests of delta wings
[BU-250] N81-20041
SLIDING FRICTION
Friction and wear studies of graphite and a carbon-carbon composite in air and helium
[GA-A-16054] N81-20191
Dry lubrication of high temperature silicon nitride rolling contacts
[AD-A095202] N81-20435
SLOPES
Comparison of observed and predicted slope winds
[PNL-SA-8785] N81-20679
SLURRIES
Critical parameters for coarse coal underground slurry haulage systems
[JPL-PUB-81-11] N81-20495
SNOW
Snow water equivalent determination by microwave radiometry
[NASA-TM-82074] N81-20490
A watershed information system
[PB81-127433] N81-20528
SODIUM
Average nocturnal and seasonal variations of sodium nightglow at 23 deg S, 48 deg W
[INPE-1957-RPE/271] N81-20634
SODIUM CARBONATES
Molten salt coal gasification process development unit, phase 1. Volume 1: PDU operations
[DOE/ET-10296/66-VOL-1] N81-20296
SOILS
Fundamentals of remote sensing relations between spectral signatures and physical properties of crops
[NLR-MP-79035-U] N81-20527
SOLAR ACTIVITY
Balloon Electrical Environment Profiling System (BEEPS)
[AD-A095531] N81-20669
SOLAR ARRAYS
Satellite Power Systems (SPS) concept definition study (Exhibit D). Volume 6, part 1: Cost and Programmatics
[NASA-CR-3397] N81-20537
LSA field test
[NASA-CR-164083] N81-20544
Proceedings of the 16th Project Integration Meeting
[NASA-CR-164073] N81-20545
Satellite Power System (SPS) utility integration: Institutional, planning and operational issues
[EAC-R-4015] N81-20596
The 10-kilowatt photovoltaic concentrator array fabrication
[SAND-80-7062] N81-20599
Study of interaction between solar arrays and attitude - orbit control. Volume 1: Technical Report
[ESS/SS-987-VOL-1] N81-20603
SOLAR CELLS
Analysis of costs of gallium arsenide and silicon solar arrays for space power applications
[NASA-TP-1811] N81-20173
Proceedings of the 16th Project Integration Meeting
[NASA-CR-164073] N81-20545
The correction for spectral mismatch effects on the calibration of a solar cell when using a solar simulator
[NASA-CR-164074] N81-20546
Results of the 1980 NASA/JPL balloon flight solar cell calibration program
[NASA-CR-164078] N81-20548
Further development of a novel solar cell concentrator photovoltaic converter system
[SAND-80-7072] N81-20572
Low cost, sprayed CdTe solar cell research
[SERI/PR-8104-3-T2] N81-20585
Investigation of solar cells based on Cu20
[DOE/ET-23006/4] N81-20593
Experimental study to define developments for terrestrial solar cell generators
[BMFT-FB-T-79-143] N81-20600
Materials and methods for the development of solar energy --- thin film cells
[BMFT-FB-T-80-065] N81-20601
Fabrication of amorphous silicon solar cells, using an industrial process --- based on a nitride plasma reactor
[LEP-80.638.SME-689-A] N81-20602
SOLAR COLLECTORS
Evaluation of solar collectors for heat pump applications
[DOE/CS-35351/T1] N81-20568
Solar collector foundation designs
[SAND-80-7070] N81-20582
Flat plate thermal solar collectors: A physical background
[PB81-135741] N81-20605
SOLAR COOLING
Sunspace Minnesota: Passive solar design for winter resorts
[DOE/R5-10130/2] N81-20566
Coordination and management tasks for the IEA solar heating and cooling program and CCMS solar energy pilot study
[DOE/CS-30108/T3] N81-20567
Residential solar data center MIRADS user's guide
[PB81-132268] N81-20606
SOLAR CORONA
Theoretical studies of highly ionized species
[DOE/ER-02687/2] N81-20650
SOLAR CORPUSCULAR RADIATION
Elemental composition of solar energetic particles
[NASA-CR-164061] N81-21002
SOLAR ELECTRIC PROPULSION
Interplanetary missions: Upcoming technological aspects --- solar sails and solar electric propulsion N81-20138
SOLAR ENERGY
Heat exchange and solar energy, volume 2 --- conference proceedings, Rhode Saint Genese, Belgium
[VKI-LEC-SER-1980-2-VOL-2] N81-20549
Latent and chemical storage --- solar energy, thermochemical storage N81-20550
The benefits of advanced heat storage systems --- solar energy, phase changes, encapsulation, heat of fusion N81-20551
The a priori decision in solar energy and conservation economics N81-20558
Photovoltaics information user study
[SERI/TR-751-652] N81-20570
SOLAR ENERGY ABSORBERS
Study of the effectiveness of selective absorber coatings and phase change materials in passive solar space heating
[LA-UR-80-2930] N81-20936
SOLAR ENERGY CONVERSION
Considerations in the design of solar engines N81-20536
LSA field test
[NASA-CR-164083] N81-20544
Further development of a novel solar cell concentrator photovoltaic converter system
[SAND-80-7072] N81-20572
October 1980 environmental data for sites in the National Solar Data Network
[SOLAR/0010-80/10] N81-20588
High concentration silicon photovoltaic cell development
[SAND-80-7068] N81-20595
SOLAR FLARES
Elemental composition of solar energetic particles
[NASA-CR-164061] N81-21002
SOLAR FURNACES
Solar coal gasification
[DOE/TIC-11384] N81-20587
SOLAR GENERATORS
Thermomechanical solar power/electricity generation. Technico-economic problems and prospectives of development and application N81-20556
Experimental study to define developments for terrestrial solar cell generators
[BMFT-FB-T-79-143] N81-20600
SOLAR HEATING
A method to tune the various components of a solar heating system --- economic factors and cost analysis N81-20552
Water systems modeling --- solar collectors and heating systems N81-20554
System modeling using TRNSYS computer simulation --- solar heating N81-20555
A life-cycle model for solar heating system design and economic evaluation Michigan Economic Model for Solar Heating (MESH) N81-20559
Sunspace Minnesota: Passive solar design for winter resorts
[DOE/R5-10130/2] N81-20566
Coordination and management tasks for the IEA solar heating and cooling program and CCMS solar energy pilot study
[DOE/CS-30108/T3] N81-20567
Optimization of storage in passive solar heating systems
[DOE/CS-35405/T1] N81-20574
Handbook for calculating solar-influenced building heat losses
[SAND-79-2173] N81-20583
Residential solar data center MIRADS user's guide
[PB81-132268] N81-20606

Study of the effectiveness of selective absorber coatings and phase change materials in passive solar space heating
[LA-UR-80-2930] N81-20936

SOLAR HOUSES
Performance of air collector house heating systems with rock bed storage --- solar heating N81-20553
Performance evaluation of the Balcomb solar house
[LA-UR-80-3453] N81-20586

SOLAR MAGNETIC FIELD
Synoptic solar magnetic field maps for the interval including Carrington Rotation 1601-1680, May 5, 1973 - April 26, 1979
[PB81-125569] N81-21003

SOLAR ORBITS
A scanning satellite. Maintaining the orbit. SPOT N81-20130
Choice and acquisition of the SPOT satellite orbit N81-20131

SOLAR PHYSICS
Auroral Electrojet magnetic activity indices AE(12) for July-December 1975
[PB81-125551] N81-20653

SOLAR PONDS (HEAT STORAGE)
Heat loss modeling for the ANL Research Solar Pond
[ANL-CT-80-22] N81-20589

SOLAR POWER SATELLITES
A theoretical study of microwave beam absorption by a rectenna
[NASA-CR-160921] N81-20328
A theoretical study of microwave beam absorption by a rectenna, introduction --- solar power satellites N81-20329
Tropospheric/ionospheric transmission tests N81-20335
Measurements of possible D- and E-region telecommunications effects during ionospheric heating --- solar power satellite
[DOE/ER-10161/1] N81-20349

SOLAR RADIATION
New observations on the daily variations of natural ice albedo
[PB81-132789] N81-20532
Considerations in the design of solar engines N81-20536
Determination of regional evapotranspiration using energy balance, planetary boundary layer transfer coefficients and regularly recorded data N81-20626

SOLAR REFLECTORS
Cost/performance of solar reflective surfaces for parabolic dish concentrators
[NASA-CR-164088] N81-20547
Further development of a novel solar cell concentrator photovoltaic converter system
[SAND-80-7072] N81-20572
Adhesion and chemical vapor testing of second surface silver/glass solar mirrors
[PNL-3575] N81-20577
Alternate protection concepts for second surface silver/glass solar mirrors
[PNL-3629] N81-20578

SOLAR ROTATION
Synoptic solar magnetic field maps for the interval including Carrington Rotation 1601-1680, May 5, 1973 - April 26, 1979
[PB81-125569] N81-21003

SOLAR SAILS
Interplanetary missions: Upcoming technological aspects --- solar sails and solar electric propulsion N81-20138

SOLAR SYSTEM
The solar system --- description and physics N81-20135

SOLAR TOTAL ENERGY SYSTEMS
Performance evaluation of the Balcomb solar house
[LA-UR-80-3453] N81-20586

SOLAR WIND
On the complex state of the interplanetary medium of 28-29 July 1977
[NASA-TM-82095] N81-20996
Fine-scale characteristics of interplanetary sector
[NASA-TM-82281] N81-20997
Solar wind energy and electric field transfer to the Earth's magnetosphere via magnetopause reconnection
[INPE-1940-RPE/259] N81-21001

SOLID LUBRICANTS
Dynamics of solid dispersions in oil during the lubrication of point of contacts. Part 2: Molybdenum disulfide
[NASA-TM-81709] N81-20275
Dry lubrication of high temperature silicon nitride rolling contacts
[AD-A095202] N81-20435

SOLID PHASES
Plasma chemistry for inorganic materials
[NASA-TM-75844] N81-20889

SOLID PROPELLANTS
A theoretical investigation of the pyrolysis of solid fuels including condensation effects N81-20213
A study of flame spreading and combustion processes in solid propellant cracks N81-20214
Viscoelastic propellant effects on Space Shuttle Dynamics
[NASA-TM-82403] N81-20289

SOLID STATE
Numerical procedure for predicting the torsional dynamic response of solid media N81-20460

SOLID STATE DEVICES
The application of nuclear techniques to solid state devices
[AD-A095251] N81-20933

SOLIDS
A strong coupled electron-acoustic phonon system in one dimension N81-20925

SOLVENT REFINED COAL
Solvent Refined Coal (SRC) process: Trace elements research and development. Volume 3: Pilot plant development work, part 6: The fate of trace elements in the SRC process
[DOE/ET-10104/T11] N81-20308

SOOT
Graphitic carbon in urban environments and the Arctic
[LBL-11677] N81-20612
Soot in the atmosphere
[LBL-11676] N81-20616

SORPTION
A chromatographic and spectroscopic characterization of chemically bonded stationary phases N81-20195

SOUND PROPAGATION
Boundary layer effects on an acoustic field N81-20826
High-frequency sound propagation in a spatially varying mean flow
[NASA-TM-81751] N81-20831

SOUNDING ROCKETS
Magnetospheric sounding rocket program: The magnetometer experiment in the substorm phenomena payload
[BMFT-FB-W-79-34] N81-20649

SOUTHERN CALIFORNIA
Evidence for fault asperities from systematic time-domain modeling of teleseismic waveforms N81-20630

SOUTHERN HEMISPHERE
Some large scale aspects of the Southern Ocean and its environment N81-20685

SPACE CHARGE
Precharge enhanced SGEMP
[AD-A095503] N81-20150
Diagnostic system design for the Ion Auxiliary Propulsion System (IAPS). Flight tests of two 8 cm mercury ion
[NASA-TM-81702] N81-20172
One-dimensional space-charge neutralization of the ion beams
[SAND-80-2545] N81-20844

SPACE COMMUNICATION
Satellite-aided mobile radio concepts study: Concept definition of a satellite-aided mobile and personal radio communication system
[NASA-CR-166646] N81-20338
The Deep Space Network: An instrument for radio science research
[NASA-CR-164077] N81-20339

SPACE COOLING (BUILDINGS)
Simulation of aeroheating or aerocooling Air Force stores by arrays of impinging jets
[AD-A095464] N81-20034
Performance evaluation of the Balcomb solar house
[LA-UR-80-3453] N81-20586

SPACE EXPLORATION
Comet Science Working Group report on the Halley Intercept Mission
[NASA-TM-82386] N81-20100
Beyond the atmosphere: Early years of space science
[NASA-SP-4211] N81-20962
The meaning of space science N81-20963
The context --- technological spinoffs from aerospace research N81-20964
Early harvest: The upper atmosphere and cosmic rays N81-20968
Response to Sputnik: The creation of NASA N81-20969
Rockets and spacecraft: Sine qua non of space science N81-20972
Who decides? --- program proposals; relations between NASA and the scientific community N81-20974
Continuing harvest: The broadening field of space science N81-20982
Surface penetrators for planetary exploration: Science rationale and development program
[NASA-TM-81251] N81-21000

SPACE FLIGHT
Preliminary results of scientific research on biosatellite Kosmos-1129
[NASA-TM-76287] N81-20700
The meaning of space science N81-20963
Prophets and pioneers of spaceflight N81-20965

SPACE FLIGHT STRESS
Activity of certain enzymes in subcellular fractions of rat liver after flight on Cosmos 1129 biosatellite
[NASA-TM-76472] N81-20701

SPACE HEATING (BUILDINGS)
Simulation of aeroheating or aerocooling Air Force stores by arrays of impinging jets
[AD-A095464] N81-20034
Optimal distribution of thermal insulation and ground heat losses
[PB81-122871] N81-20317
Performance of air collector house heating systems with rock bed storage --- solar heating N81-20553
Sunspace Minnesota: Passive solar design for winter resorts
[DOE/R5-10130/2] N81-20566
Groundwater as an alternative energy source for space heating and cooling, geothermal heat extraction
[DOE/TIC-11357] N81-20571
Handbook for calculating solar-influenced building heat losses
[SAND-79-2173] N81-20583
Performance evaluation of the Balcomb solar house
[LA-UR-80-3453] N81-20586
Study of the effectiveness of selective absorber coatings and phase change materials in passive solar space heating
[LA-UR-80-2930] N81-20936

SPACE LABORATORIES
With the solaris project CNES proposes to the Europeans the construction of an entirely automatic space laboratory
[NASA-TM-76492] N81-20144

SPACE MANUFACTURING
Graphite composite truss welding and cap section forming subsystems. Volume 1: Executive summary --- large space structures
[NASA-CR-160933] N81-20462

SPACE MECHANICS
Basic notions in rational mechanics and applications to space mechanics N81-20109
Generalities and definition of a system --- for command and control of satellite attitude and orbit N81-20118

SPACE MISSIONS
Space missions and orbit/attitude systems N81-20126
Overview of the SPOT mission and description of the ground segment N81-20519

SPACE NAVIGATION
Autonomous spacecraft maintenance study group
[NASA-CR-164076] N81-20168

SPACE PLATFORMS
Space platform advanced technology study
[NASA-CR-160934] N81-20146

SPACE PROCESSING
Ultrapure metals preparation in space
[NASA-CR-161678] N81-20101

SPAR 6 experiment report containerless processing of glass experiment 74-42
[NASA-CR-161674] N81-20102
Study on fluid phenomena influencing the design of zero-gravity experiments. Volume 2: Users' guide
[TS-11-79-VOL-2] N81-20106

SPACE PROGRAMS
Comet Science Working Group report on the Halley Intercept Mission
[NASA-TM-82386] N81-20100
The 1981 Budget of the German Federal Ministry for Research and Technology
[NASA-TM-76493] N81-20956
Beyond the atmosphere: Early years of space science
[NASA-SP-4211] N81-20962
The rocket and satellites research panel: The first space scientists N81-20966
The Academy of Sciences stakes a claim N81-20967
International ties --- international cooperation in the space sciences N81-20980
Objectives, plans, and budgets --- nasa programs N81-20983
Review and assessment --- NASA space program N81-20984

SPACE RENDEZVOUS
Comet Science Working Group report on the Halley Intercept Mission
[NASA-TM-82386] N81-20100

SPACE SHUTTLE BOOSTERS
Viscoelastic propellant effects on Space Shuttle Dynamics
[NASA-TM-82403] N81-20289

SPACE SHUTTLE MAIN ENGINE
Transfer film evaluation for shuttle engine turbopump bearing
[NASA-CR-161672] N81-20425

SPACE SHUTTLE ORBITERS
Shuttle/payload communications and data systems interface analysis
[NASA-CR-160929] N81-20157
Shuttle/payload communications and data systems interface analysis: Executive summary
[NASA-CR-160929] N81-20158
Shuttle/payload communications and data systems interface analysis: Introduction N81-20159
Payload/orbiter signal processing and data handling system evaluation presentation N81-20160
Preliminary interface revision notice SD-152C update of section 8.3 of ICD 2-19001 for detached payloads N81-20163
Shuttle orbiter Ku-band radar/communications system design evaluation
[NASA-CR-160898] N81-20327

SPACE SHUTTLE PAYLOADS
An update of nonstandard payload modulation restrictions N81-20162
Preliminary interface revision notice SD-152C update of section 8.3 of ICD 2-19001 for detached payloads N81-20163
Orbiter Camera Payload System
[NASA-CR-160937] N81-20865
The Passive Optical Sample Assembly (POSA) on STS-1
[NASA-TM-82407] N81-20868

SPACE SHUTTLES
Columbia's first flight shakes down space transportation system
[NASA-NEWS-RELEASE-81-39] N81-20156
Shuttle/payload communications and data systems interface analysis
[NASA-CR-160929] N81-20157
Payloads minimum EIRP formulations N81-20161
Study of heat rejection systems --- space shuttle radiator using freon
[TC-80-TR-0054] N81-20165
Wind profiles for Space Shuttle loads analysis
[NASA-CR-161676] N81-20666
Space Construction System Analysis. Part 2: Executive summary
[NASA-CR-160902] N81-20797

SPACE SURVEILLANCE (SPACEBORNE)
Spaceborne scanners for photoelectric detection N81-20508

SPACE TRANSPORTATION SYSTEM
Launch systems for the 1980's --- their evolution, and prospects for the STS and ARIANE systems N81-20124
Columbia's first flight shakes down space transportation system
[NASA-NEWS-RELEASE-81-39] N81-20156

SPACE TRANSPORTATION SYSTEM FLIGHTS
Space Shuttle Program. Mission operation report. Orbital Flight Test reference document
[NASA-TM-82321] N81-20164

SPACE TRANSPORTATION SYSTEM 1 FLIGHT
The Passive Optical Sample Assembly (POSA) on STS-1
[NASA-TM-82407] N81-20868

SPACE-TIME FUNCTIONS
Space and time reference systems N81-20111
Thundercloud local electric field intensification during the pre-breakdown phase of lightning --- time and space evolution N81-20657
A Newman-Penrose type formalism for space-times with torsion. Part 2: Exact plane wave solutions
[MATH-RES-143-PT-2] N81-20944

SPACEBORNE ASTRONOMY
The design study of a far infrared heterodyne spectrometer assembly, volume 1 --- spaceborne applications
[ESS/CCG-118-VOL-1] N81-20989

SPACEBORNE EXPERIMENTS
Study on fluid phenomena influencing the design of zero-gravity experiments, volume 1
[TS-1-80-VOL-1] N81-20105
Study on fluid phenomena influencing the design of zero-gravity experiments. Volume 2: Users' guide
[TS-11-79-VOL-2] N81-20106
Catalog of French cold gas equipment for use in space applications
[CNES-CT/PRT/SST/SE/349] N81-20313
Islet in weightlessness: Biological experiments on board COSMOS 1129 satellite
[NASA-TM-76396] N81-20692

SPACEBORNE PHOTOGRAPHY
Photographic cameras and return beam vidicons --- functioning onboard spacecraft N81-20507
Analog rectification --- transformation of a council perspective (remote sensor imagery) into an orthogonal cylindrical perspective (map) N81-20516

SPACECRAFT COMMUNICATION
The exchange of information between a satellite and the ground for control operations, and starting up the ground system N81-20132
Columbia's first flight shakes down space transportation system
[NASA-NEWS-RELEASE-81-39] N81-20156
Shuttle/payload communications and data systems interface analysis
[NASA-CR-160929] N81-20157
Shuttle/payload communications and data systems interface analysis: Executive summary
[NASA-CR-160929] N81-20158
Shuttle/payload communications and data systems interface analysis: Introduction N81-20159
Payload/orbiter signal processing and data handling system evaluation presentation N81-20160
An update of nonstandard payload modulation restrictions N81-20162
Preliminary interface revision notice SD-152C update of section 8.3 of ICD 2-19001 for detached payloads N81-20163
High power amplifier 14 GHz for satellite ground stations
[BMFT-FB-T-79-158] N81-20370

SPACECRAFT CONSTRUCTION MATERIALS
Materials data retrieval at ESTEC --- for spacecraft construction
[ESA-STM-206] N81-20954

SPACECRAFT CONTROL
Modifications to the Flexible Spacecraft Dynamics Program
[NASA-CR-166655] N81-20166
Analysis and simulation of a magnetic bearing suspension system for a laboratory model annular momentum control device
[NASA-TP-1799] N81-20311
Description of a digital computer simulation of an Annular Momentum Control Device (AMCD) laboratory test model
[NASA-TM-81797] N81-20741
The reduced order model problem in distributed parameter systems adaptive identification and control --- adaptive control of flexible spacecraft
[NASA-CR-164059] N81-20761

SPACECRAFT DESIGN
Autonomous spacecraft maintenance study group
[NASA-CR-164076] N81-20168
Summary of Jimsphere wind profiles: Programs, data, comments, part 1 --- for use in aeronautical vehicle design and engineering
[NASA-CR-161664] N81-20667
Space Construction System Analysis. Part 2: Executive summary
[NASA-CR-160902] N81-20797

SPACECRAFT DOCKING
Space platform advanced technology study
[NASA-CR-160934] N81-20146

SPACECRAFT ENVIRONMENTS
Lightside atmospheric revitalization system
[NASA-CR-160897] N81-20731

SPACECRAFT INSTRUMENTS
Development of a parametric amplifier for satellite transponder applications at 14 to 14.5 GHz
[BMFT-FB-W-79-27] N81-20375

SPACECRAFT LANDING
Columbia's first flight shakes down space transportation system
[NASA-NEWS-RELEASE-81-39] N81-20156

SPACECRAFT LAUNCHING
Spacecraft launching --- launch vehicle considerations N81-20123
Using the ARIANE launch vehicle N81-20125
Positioning a geostationary satellite N81-20127
Choice and acquisition of the SPOT satellite orbit N81-20131

SPACECRAFT LUBRICATION
Transfer film evaluation for shuttle engine turbopump bearing
[NASA-CR-161672] N81-20425

SPACECRAFT MANEUVERS
Space missions and orbit/attitude systems N81-20126

SPACECRAFT MODELS
Synthesis of work concerning eddy current pendular nutation dampers. Application of theory to equipment qualification and verification on a spin simulator
[CNES-78/CT/PRT/SST/SS/197] N81-20169

SPACECRAFT MOTION
Space vehicle orbital motion --- conferences
[ISSN-0244-8041] N81-20108
General reflections --- on spacecraft motion and its influence on the geometric quality of imagery N81-20500

SPACECRAFT ORBITS
Orbit perturbation: Causes and representation N81-20112
Measurement for orbit determination --- comparison of ground based satellite position observation techniques N81-20115
Interplanetary orbit control N81-20137

SPACECRAFT PERFORMANCE
Autonomous spacecraft maintenance study group
[NASA-CR-164076] N81-20168

SPACECRAFT POWER SUPPLIES
Satellite Power System (SPS) utility integration: Institutional, planning and operational issues
[EAC-R-4015] N81-20596

SPACECRAFT PROPULSION
Interplanetary missions: Upcoming technological aspects --- solar sails and solar electric propulsion N81-20138

SPACECRAFT RADIATORS
Study of heat rejection systems --- space shuttle radiator using freon
[TC-80-TR-0054] N81-20165

SPACECRAFT REENTRY
Space vehicle atmospheric reentry trajectories N81-20140

SPACECRAFT STABILITY
Attitude and orbit command --- guidance with spin stabilization or three axis stabilization N81-20119
Natural nutation damping due to the ergols of the hot gaz propulsion system. Synthesis of MV1 and MV2 in-flight results
[CNES-79/CT/PRT/SST/SS/166] N81-20170

SPACECRAFT STRUCTURES
Study of interaction between solar arrays and attitude - orbit control. Volume 1: Technical Report
[ESS/SS-987-VOL-1] N81-20603
Space Construction System Analysis. Part 2: Executive summary
[NASA-CR-160902] N81-20797

SPACECRAFT TRAJECTORIES
Space vehicle orbital motion --- conferences
[ISSN-0244-8041] N81-20108
Basic notions in rational mechanics and applications to space mechanics N81-20109
The calculation of interplanetary trajectories --- for spacecraft N81-20136
Models of the upper Earth atmosphere. Application to satellite trajectory determination N81-20139
Space vehicle atmospheric reentry trajectories N81-20140
Columbia's first flight shakes down space transportation system
[NASA-NEWS-RELEASE-81-39] N81-20156

SPACELAB
Study of heat rejection systems --- space shuttle radiator using freon
[TC-80-TR-0054] N81-20165

SPACELAB PAYLOADS
Degradation of the surface finish of the SPACELAB pallet after ultraviolet irradiation --- paints
[ESA-STM-215] N81-20284

SPATIAL DISTRIBUTION
The nature of the spatial structure of diffuse soft X-rays in the direction of the North Polar Spur N81-21004

SPATIAL FILTERING
Study of a real-time X-Y addressable spatial filter --- for onboard satellite optical data processing
[CD-8500621/3] N81-20154
Image enhancement in real time N81-20813
A detection and processing scheme for moving target detection using a passive sensor N81-20815

SPATIAL RESOLUTION
Research into methods of image processing for target enhancement and detection N81-20812

SPECIFIC HEAT
Extrinsic specific heat of phosphorus doped silicon
[INPE-1942-RPE/261] N81-20216
A search for the origin of low temperature anomalies in glasses N81-20922

SPECIFICATIONS
On bounds for the specification of finite data types by means of equations and conditional equations --- algebraic data types
[MC-IW-131/80] N81-20781

SPECKLE PATTERNS
Time-average optical methods for strain analysis N81-20453

SPECTRA
Comparison of wind spectra from spatially averaged and point measurements in complex terrain
[UCRL-84546] N81-20678

SPECTRAL CORRELATION
The correction for spectral mismatch effects on the calibration of a solar cell when using a solar simulator
[NASA-CR-164074] N81-20546

SPECTRAL RECONNAISSANCE
An approach to airborne infrared search set performance modeling N81-20805

SPECTRAL REFLECTANCE
Critical evaluation of the radiometric requirements of satellite onboard equipment for the measurement of ocean color
[ESA-CR(P)-1390] N81-20526

SPECTRAL SENSITIVITY
Fundamentals of remote sensing relations between spectral signatures and physical properties of crops
[NLR-MP-79035-U] N81-20527
Research into methods of image processing for target enhancement and detection N81-20812

SPECTRAL SIGNATURES
Development of the Coastal Zone Color Scanner for NIMBUS 7. Volume 2: Test and performance data, revision A
[NASA-CR-166649] N81-20491
Fundamentals of remote sensing relations between spectral signatures and physical properties of crops
[NLR-MP-79035-U] N81-20527
Aircraft program for target, background, and sky radiance measurements
[AD-A095363] N81-20646
Target detection and classification in infrared imagery N81-20806

SPECTROGRAPHS
Improved emission spectrographic facility
[DPSPU-80-30-7] N81-20228

SPECTROSCOPIC ANALYSIS
Characterization of the physico-chemical properties of polymeric materials for aerospace flight --- differential thermal and atomic absorption spectroscopic analysis of nickel cadmium batteries
[NASA-CR-164062] N81-20276

SPECTROSCOPY
Applications of microcomputers to spectroscopy and electrochemistry N81-20209

SPECTRUM ANALYSIS
Comparison of wind spectra from spatially averaged and point measurements in complex terrain
[UCRL-84546] N81-20678
Discovery of water vapor maser in the large Magellanic cloud
[INPE-1959-RPE/273] N81-20995

SPEECH RECOGNITION
Automated intelligibility measurement system
[AD-A095664] N81-20739

SPEED INDICATORS
A short note on AIDS and windshear: British airways experience --- with a modified vertical speed indicator N81-20012

SPHERICAL SHELLS
Improved acoustic approximations for submerged shells --- spherical shells N81-20829

SPHERICAL WAVES
A FORTRAN computer program for calculating the propagation of plane, cylindrical or spherical finite amplitude waves
[AD-A095386] N81-20832

SPIN DYNAMICS
The prediction of normal force and rolling moment coefficients for a spinning wing
[NASA-CR-165680] N81-20068

SPIN STABILIZATION
Attitude and orbit command --- guidance with spin stabilization or three axis stabilization N81-20119

SPIN TESTS
Synthesis of work concerning eddy current pendular nutation dampers. Application of theory to equipment qualification and verification on a spin simulator
[CNES-78/CT/PRT/SST/SS/197] N81-20169
Magnetic bearing reaction wheel tests --- satellite applications
[CNES-80/CT/PRT/SST/SS/162] N81-20444

SPLEEN
Comparison of early reactions of the blood system in rats to immobilization, the action of hypoxia and the administration of erythopoietin
[NASA-TM-76169] N81-20699

SPLINE FUNCTIONS
Image processing techniques using spline approximation N81-20809

SPORES
Response of selected microorganisms to experimental planetary environments
[NASA-CR-164064] N81-20733

SPOT (FRENCH SATELLITE)
A scanning satellite. Maintaining the orbit. SPOT N81-20130
Choice and acquisition of the SPOT satellite orbit N81-20131

SPRAY CHARACTERISTICS
Effect of additives on the lean detonation limit of kerosene sprays in air
[AD-A095190] N81-20221

SPRAYED COATINGS
Low cost, sprayed CdTe solar cell research
[SERI/PR-8104-3-T2] N81-20585

SPRAYERS
Effect of additives on the lean detonation limit of kerosene sprays in air
[AD-A095190] N81-20221

SPREAD F
Longitudinal differences in the spread F characteristics in the American zone and implications on the F-region dynamo
[INPE-1941-RPE/260] N81-20635

SPREAD SPECTRUM TRANSMISSION
Adaptive spread spectrum receiver using acoustic surface wave technology
[AD-A095737] N81-20347

SPUTNIK SATELLITES
Response to Sputnik: The creation of NASA N81-20969
Deepening perspective: A new look at the old world --- satellites and the earth sciences N81-20973

SPUTTERING
Sputtering and ion plating for aerospace applications
[NASA-TM-81726] N81-20424
Ion implantation of krypton in sputter-deposited metal matrices --- storing krypton 85
[PNL-SA-8661] N81-20939

STAINLESS STEELS
Kinetics of the degradation of type 316 stainless steel by liquid lithium N81-20239
Deformation microstructure developed during fatigue crack propagation in type 316 stainless steel at 593 deg C
[AD-A095387] N81-20246
Insert type milling cutter evaluation
[SAND-80-2185C] N81-20439
Development of an irradiation creep correlation for 20% cold-worked AISI 316 in fusion environments: DAFS contribution
[DOE/FF-02170/T58] N81-20475

STANDARDS
A reference building approach to building energy performance standards for single-family residences
[PB81-135642] N81-20318
Minimum operational performance standards for airborne radar approach and beacon systems for helicopters
[RTCA/DO-172] N81-20322
Minimum operational performance standards for airborne weather and ground mapping pulsed radars
[RTCA/DO-173] N81-20323
Results of the 1980 NASA/JPL balloon flight solar cell calibration program
[NASA-CR-164078] N81-20548
Dimensions/NBS. Volume 64, no. 8, October 1980
[PB81-133654] N81-21007

STAR CLUSTERS
Studies of stellar populations: Star clusters in M31, the galaxy and the Magellanic Clouds N81-20986

STAR DISTRIBUTION
The nature of the spatial structure of diffuse soft X-rays in the direction of the North Polar Spur N81-21004

STARS
The chemical abundances and physical parameters of RR Lyrae stars N81-20985

STATIC TESTS
Static test of a wing box structure made of composite materials, phase 1
[FFA-TN-HU-2127] N81-20481

STATIONKEEPING
Geostationary satellite stationkeeping. Orbit perturbation --- and correction N81-20128
Geostationary satellite stationkeeping: Orbit correction strategies N81-20129
Ground equipment for moving satellites and geostationary satellites --- used in the ground support function N81-20133

STATISTICAL ANALYSIS
Evaluation of national SAR manual: Probability of detection curves
[AD-A095748] N81-20048
A statistical data analysis and plotting program for cloud microphysics experiments
[NASA-CR-161663] N81-20665
Contributions to survey sampling and design of experiments N81-20790
Simple estimation procedures based on rank tests for the one- and two-sample location models N81-20791

STATISTICAL CORRELATION
A Monte Carlo comparison of robust and resistant estimators of bivariate correlation N81-20785

STATISTICAL DECISION THEORY
Aspects of symmetric Bayesian sequential decision problems N81-20789

STATISTICAL DISTRIBUTIONS
On a class of multivariate exponential densities N81-20786

STATISTICAL MECHANICS
Self-consistent many body theory for the standard basis operator Green's functions
[INPE-1962-RPE/275] N81-20942

STATISTICAL TESTS
Tests for dependence in multivariate observations N81-20788
Statistics for peak values of multiple coherence
[AD-A095460] N81-20795

STATISTICAL WEATHER FORECASTING
Stepwise linear regression experiments in 14 and 19 day hemispheric weather prediction
[INPE-1948-RPE/265] N81-20662

STDN (NETWORK)
Columbia's first flight shakes down space transportation system
[NASA-NEWS-RELEASE-81-39] N81-20156

STEAM FLOW
Steam turbines for large power outputs --- conference, Belgium, 11-15 Feb. 1980
[VKI-LS-1980-6] N81-20426
Nonequilibrium effects in wet-steam turbines N81-20430
Flow in a 320 MW low-pressure section: Theoretical and experimental evaluation --- of the steam fluid dynamic behavior and turbine performance N81-20432

STEAM TURBINES
Steam turbines for large power outputs --- conference, Belgium, 11-15 Feb. 1980
[VKI-LS-1980-6] N81-20426
Steam turbines for large power outputs N81-20427
Design of nonrotating parts --- in steam turbines N81-20428
Nonequilibrium effects in wet-steam turbines N81-20430
Field turbine tests --- of large steam turbine generator units N81-20431
Flow in a 320 MW low-pressure section: Theoretical and experimental evaluation --- of the steam fluid dynamic behavior and turbine performance N81-20432
Experimental development of bladings for large steam turbines N81-20433
Detection of water induction in steam turbines
[EPRI-CS-1604] N81-20438
Study of the potential for cogeneration in Canada: Industrial steam turbines. Volume 1: Main report
[NP-25187-VOL-1] N81-20563
Study of the potential for cogeneration in Canada: Industrial steam turbines. Volume 2: Economic potential
[NP-25187-VOL-2] N81-20564

STEEL STRUCTURES
Cyclic inelastic buckling of tubular steel braces
[PB81-124885] N81-20484

STEELS
Mechanism of work hardening in Hadfield manganese steel N81-20243
The microstructural and property changes of laser treated electrodeposits
[AD-A095345] N81-20254
Galvanizing
[PB81-120271] N81-20271

STELLAR ATMOSPHERES
The chemical abundances and physical parameters of RR Lyrae stars N81-20985

STELLAR GRAVITATION
A study of the interstellar medium in NGC 185 and other early-type galaxies N81-20992

STELLAR RADIATION
Virgo cluster galaxies: Neutral hydrogen studies N81-20991

STELLAR SPECTRA
The chemical abundances and physical parameters of RR Lyrae stars N81-20985
MM-wave and X-ray observastions of a Cen-A flare
[INPE-1958-RPE/272] N81-21005

STELLAR STRUCTURE
Studies of stellar populations: Star clusters in M31, the galaxy and the Magellanic Clouds N81-20986

STEREOPHOTOGRAPHY
Orbiter Camera Payload System
[NASA-CR-160937] N81-20865

STEREOSCOPY
Positioning SPOT images: Reconstitution from a stereoscopic pair --- and photogrammetric implications N81-20510

STIFFNESS MATRIX
The 3D solid element (type 4 - elastic or elastic-perfectly-plastic) for the ANSR-11 program --- nonlinear structural response
[PB81-123242] N81-20485

STIMULANT
Comparison of early reactions of the blood system in rats to immobilization, the action of hypoxia and the administration of erythopoietin
[NASA-TM-76169] N81-20699

STIMULATION
Changes in mast cells and in permeability of mesenteric microvessels under the effect of immobilization and electrostimulation
[NASA-TM-75988] N81-20694

STIRLING CYCLE
Considerations in the design of solar engines N81-20536

STOCHASTIC PROCESSES
Determination of the degree of observability in linear control systems N81-20355
The closeness of uniform random points in a square and a circle
[AD-A095697] N81-20772
On a class of multivariate negative binomial distributions
[AD-A095445] N81-20793

STOICHIOMETRY
Stoichiometry of wood liquefaction
[LBL-11776] N81-20298

STORAGE BATTERIES
Silver-iron batteries
[STU-78-4981] N81-20597

STORAGE RINGS (PARTICLE ACCELERATORS)
Semiconductor devices as track detectors in high energy colliding beams experiments
[BNL-28850] N81-20861

STRAIN GAGES
An experimental device for measurement of the viscoelastic properties of thickened liquids
[AD-A095396] N81-20225
Thin film strain transducer --- in-flight measurement of stress or strain in walls of high altitude balloons
[NASA-CR-156875] N81-20406
Development of a new noninvasive method to determine the integrity of bone in vivo
[NASA-CR-160922] N81-20722

STRAIN HARDENING
Fracture mechanics and dynamic response of structures
[AD-A095272] N81-20469

STRAIN RATE
Mechanism of work hardening in Hadfield manganese steel N81-20243

STRAITS
HF (High Frequency) radar measurements of circulation in the Eastern Strait of Juan de Fuca near Protection Island (July 1979)
[PB81-127490] N81-20690

STRAPDOWN INERTIAL GUIDANCE
Strapdown inertial optical system (SIOS) --- for observation and communication satellites
[REPT-0002/DX60] N81-20153

STRATEGY
Geostationary satellite stationkeeping: Orbit correction strategies N81-20129

STRATIFIED FLOW
Stability of rotational Couette flow of density stratified fluids N81-20380
Finite element simulations of stratified flow over simple geometrical obstructions and arbitrarily complex terrain N81-20607

STRATOSPHERE
A model of the Antarctic sink for stratospheric water vapor N81-20623

STREAM FUNCTIONS (FLUIDS)
Point process models of rainfall N81-20656

STRESS (PHYSIOLOGY)
The role of ACTH and glucocorticoids in nonenzymatic fibrinolysis during immobilization stress in animals
[NASA-TM-76175] N81-20693

STRESS ANALYSIS
Stress analysis of aircraft modifications (C-141B Aircraft). Joint Airborne Communications Center/Command Post (JACC/CP) provisions
[AD-A095634] N81-20072
Non-destructive failure prediction for brittle solids
[LBL-10341-REV] N81-20448
Plastic analysis of randomly distributed grains in a tensile specimen
[SAND-80-2780] N81-20473
SPIDA: A small program for interactive display and analysis --- stress analysis and heat transfer
[REL/R(79)28] N81-20476
GIRL: German Infrared Laboratory. Telescope study, phase B
[NASA-TM-75911] N81-20866

STRESS CONCENTRATION
Thin film strain transducer --- in-flight measurement of stress or strain in walls of high altitude balloons
[NASA-CR-156875] N81-20406
Time-average optical methods for strain analysis N81-20453
An experimental study of large compressive loads upon residual strain fields and the interaction between surface strain fields created by coldworking fastener holes N81-20454

STRESS CORROSION
Long time corrosion testing with and without mechanical stress of high temperature alloys for the blades of high output land-based gas turbines
[BMFT-FB-T-79-106] N81-20266
An experimental study of large compressive loads upon residual strain fields and the interaction between surface strain fields created by coldworking fastener holes N81-20454

STRESS CORROSION CRACKING
Studies of hydrogen embrittlement and stress-corrosion cracking in an aluminum-zinc-magnesium alloy
[DOE/ER-01198/1325] N81-20256
The delayed fracture of aluminum alloys --- stress corrosion cracking
[AD-A095732] N81-20468

STRESS CYCLES
Individual jet engine stress load monitoring with the aid of the flight data recording system LEADS 200 N81-20013

STRESS INTENSITY FACTORS
Application of the line-spring model to a cylindrical shell containing a circumferential or axial part-through crack N81-20464
Dynamic piping fracture coupled with system effects
[EPRI-NP-1640] N81-20470

STRESS RELAXATION
Simultaneous stress relaxation in tension and creep in torsion of 2618 aluminum at elevated temperature
[AD-A095410] N81-20248

STRESS-STRAIN RELATIONSHIPS
A strain-space plasticity theory and numerical implementation N81-20458

STRIP MINING
Summary of the western energy overhead monitoring project
[PB81-129009] N81-20531

STRUCTURAL ANALYSIS
Statistical review of counting accelerometer data for Navy and Marine fleet aircraft
[AD-A095617] N81-20070
A comparison of damping synthesis methods for space vehicle dynamic analysis
[CNES-80/CT/PRT/SST/SM/316] N81-20171

STRUCTURAL DESIGN
Application of a structural optimization procedure for advanced wings
[AGARD-R-691] N81-20064
Comments on settling chamber design for quiet, blowdown wind tunnels
[NASA-TM-81948] N81-20085
Structural response and input identification
[NASA-CR-164079] N81-20465
Large wind energy converter: Growian 3 MW
[NASA-TM-75404] N81-20543
Design, construction and testing of a dc bioeffects test enclosure for small animals --- simulating the environment of high voltage dc transmission lines
[DOE/RA-10157/1] N81-20702

STRUCTURAL ENGINEERING
Naval structural materials: Requirements, issues, and opportunities
[AD-A095724] N81-20466
Scientific and technical information output of the Langley Research Center for calendar year 1980
[NASA-TM-81950] N81-20949

STRUCTURAL MEMBERS
A linearization technique for the dynamic response of nonlinear continuae N81-20456
Dynamic stability of structural elements subjected to step loads N81-20459

STRUCTURAL PROPERTIES (GEOLOGY)
Geology and geochronology of the Halloran Hills, southeastern California, and implications concerning mesozoic tectonics of the southwestern Cordillera N81-20628

STRUCTURAL STABILITY
Category 1 structures: Safety margin at ultimate load
[LA-UR-80-2858] N81-20472
Damage tolerance of hybrid structures --- crack propagation in aluminum alloy sheet reinforced by four unidirectional fiber/epoxy strips
[BMVG-FBWT-79-27] N81-20477

STRUCTURAL WEIGHT
Application of a structural optimization procedure for advanced wings
[AGARD-R-691] N81-20064

STRUTS
A study of high-altitude manned research aircraft employing strut-braced wings of high-aspect-ratio
[NASA-CR-159262] N81-20067

SUBASSEMBLIES
Design of nonrotating parts --- in steam turbines N81-20428

SUBMERGED BODIES
A green-function method for wave interaction with a submerged body
[PB81-122269] N81-20403
Improved acoustic approximations for submerged shells --- spherical shells N81-20829

SUBMERGING
Pathogenesis of sudden death following water immersion (immersion syndrome)
[NASA-TM-76542] N81-20723

SUBROUTINES
Modifications to the Flexible Spacecraft Dynamics Program
[NASA-CR-166655] N81-20166

SUBSONIC AIRCRAFT
Integrated Application of Active Controls (IAAC) technology to an advanced subsonic transport: Project plan
[NASA-CR-3305] N81-20062
A study of high-altitude manned research aircraft employing strut-braced wings of high-aspect-ratio
[NASA-CR-159262] N81-20067

SUBSONIC FLOW
Subsonic axisymmetric base flow control using boundary layer thickness and near-wake mass balance variations N81-20024
Experiments using a three-component laser-anemometry system on a subsonic flow with vorticity --- in a wind tunnel
[RAE-TR-80081] N81-20089
A three-dimensional turbulent compressible subsonic duct flow analysis for use with constructed coordinate systems
[NASA-CR-3389] N81-20383

SUBSTRATES
Corrosion control through a better understanding of the metallic substrate/organic coating/interface
[AD-A095420] N81-20252
The application of nuclear techniques to solid state devices
[AD-A095251] N81-20933

SUGAR BEETS
Technical and economic feasibility of membrane technology
[DOE/CS-40213/T1] N81-20231

SULFIDES
Infrared spectra of some sulfides and their analogs of binary composition in the long-wave region
[NASA-TM-75901] N81-20217

SULFUR DIOXIDES
Analysis of the Lithium Sulfur Dioxide System at ultra-high rate discharges --- electrolytic cells
[AD-A095549] N81-20365

SULFUR FLUORIDES
Nonequilibrium photochemical reactions induced by lasers
[DOE/ET-33056/15] N81-20594

SUN
Synoptic solar magnetic field maps for the interval including Carrington Rotation 1601-1680, May 5, 1973 - April 26, 1979
[PB81-125569] N81-21003

SUPERCONDUCTING MAGNETS
Application of superconducting coils to the NASA prototype magnetic balance
[NASA-CR-165660] N81-20086
Mirror fusion test facility magnet system
[UCRL-52955] N81-20904

SUPERCONDUCTIVITY
Microstructure and properties of A15 superconductors formed by direct precipitation
[LBL-11605] N81-20367
Effects of strain on the superconducting properties of niobium-tin conductors
[UCRL-53069] N81-20368
Ultrasonic attenuation in normal and superconducting indium N81-20918

SUPERCONDUCTORS
Application of superconducting coils to the NASA prototype magnetic balance
[NASA-CR-165660] N81-20086
Theory of flux-flow voltage noise in type-2 superconductors N81-20920
A heat pulse study of superconducting lead/indium alloys N81-20921
Fluxoid pinning by planar defects in Pb-Bi alloy films N81-20927

SUPERFLUIDITY
An investigation of Tkachenko waves in rotating He2 N81-20916

SUPERHIGH FREQUENCIES
Shuttle orbiter Ku-band radar/communications system design evaluation
[NASA-CR-160898] N81-20327
High power amplifier 14 GHz for satellite ground stations
[BMFT-FB-T-79-158] N81-20370

SUPERPLASTICITY
Metallurgical characterization of superplastic forming
[AD-A095720] N81-20255

SUPERPOSITION (MATHEMATICS)
Damping synthesis for ARIANE payload coupled analyses
[CNES-79/CT/PRT/SST/SM/331] N81-20155

SUPERSONIC AIRCRAFT
Optimum maneuvers of supersonic aircraft, volumes 1 and 2 N81-20060

SUPERSONIC COMBUSTION RAMJET ENGINES
Operating characteristics of the Langley Mach 7 Scramjet Test Facility
[NASA-TM-81929] N81-20083

SUPERSONIC FLOW
Turbulence measurements in supersonic flows --- hot-wire versus laser anemometry N81-20392

SUPINE POSITION
Beat by beat stroke volume assessment by PDE in upright and supine exercise N81-20710

SUPPORT INTERFERENCE
Support interference of wind tunnel models: A selective annotated bibliography
[NASA-TM-81909] N81-20084

SUPPORT SYSTEMS
Ionization and emission processes in the auroral and equatorial ionosphere --- support services for operation and data analysis
[AD-A095296] N81-20647

SUPPORTS
Cyclic inelastic buckling of tubular steel braces
[PB81-124885] N81-20484

SURFACE ACOUSTIC WAVE DEVICES
Hardware implementations of Fourier Transform signal processing
[PB81-123200] N81-20351
Applications of CCD and SAW devices to image processing N81-20357

SURFACE CRACKS
Application of the line-spring model to a cylindrical shell containing a circumferential or axial part-through crack N81-20464

SURFACE DEFECTS
Defects in galvanized products. An inspection guide
[PB81-123671] N81-20452

SURFACE FINISHING
Computer Evaluation of Surface Topography (CEST) and applications to sheet steel finishing processes N81-20237
Passivation of carbon steel through mercury implantation
[NASA-CR-165292] N81-20244
Degradation of the surface finish of the SPACELAB pallet after ultraviolet irradiation --- paints
[ESA-STM-215] N81-20284

SURFACE NAVIGATION
Position surveillance using one active ranging satellite and time-of-arrival of a signal from an independent satellite
[NASA-CR-166647] N81-20147

SURFACE PROPERTIES
Quantitative ion microscopy by digital image processing N81-20205
Heterodyne interferometric and moire test methods for surface measurements N81-20914

SURFACE REACTIONS
Theoretical studies of atom surface interactions
[AD-A095341] N81-20839

SURFACE ROUGHNESS
Computer Evaluation of Surface Topography (CEST) and applications to sheet steel finishing processes N81-20237

SURFACE TEMPERATURE
The aerospace thermal model (HFLUX): Its structure and utility
[AD-A095359] N81-20397

SURFACE WATER
Basin development and water allocation
[PB81-127276] N81-20534

SURFACE WAVES
Adaptive spread spectrum receiver using acoustic surface wave technology
[AD-A095737] N81-20347
Body and surface wave modeling of observed seismic events
[AD-A095690] N81-20645

SURGERY
Surgical access to separate branches of the cat vestibular nerve
[NASA-TM-76478] N81-20715
Meniere's disease: A surgeon's tactics
[NASA-TM-76398] N81-20719

SURVEILLANCE
Bayesian optimal designs for surveillance procedures in attribute life testing
[AD-A095723] N81-20796

SURVEYS
Pilot assessment of Training simulators N81-20098
Contributions to survey sampling and design of experiments N81-20790

SUSPENSIONS
Laser spectroscopy: Rare-earth crystals and crystals in solution N81-20913

SWEDEN
Energy conservation in houses built from 1960
[SIB-R-4-1980] N81-20569

SWEEP ANGLE
An investigation of drag associated with the upswept rear fuselage of a helicopter
[BU-257] N81-20043

SWELLING
Mechanisms of elevated temperature rupture in single phase ceramics
[DOE/ER-10591/1] N81-20280

SWITCHING CIRCUITS
The 200 kV linear beam switch tube development
[AD-A095505] N81-20363
Monolithic integrated semiconductor switches with low on-resistance --- for private automatic branch exchange (PABX) applications
[BMFT-FB-T-80-016] N81-20373
Highly efficient welding power supply
[DOE/CS-40023/T1] N81-20441

SYMBOLS
A pilot training manual for the terminal configured vehicle electronic horizontal situation indicator
[NASA-TM-81959] N81-20044

SYMMETRY
On probabilistic and symmetric parallel computations
[AD-A095657] N81-20738

SYNCHRONIZERS
A quick-look system for the processing of flight data recordings N81-20021

SYNCHRONOUS SATELLITES
Positioning a geostationary satellite N81-20127
Geostationary satellite stationkeeping. Orbit perturbation --- and correction N81-20128
Geostationary satellite stationkeeping: Orbit correction strategies N81-20129
Ground equipment for moving satellites and geostationary satellites --- used in the ground support function N81-20133

SYNOPTIC METEOROLOGY
Upper tropospheric cyclonic vortices in the tropical South Atlantic
[INPE-1946-RPE/263] N81-20660
SYNTAX
Memory, meaning and syntax
[AD-A095451] N81-20951
SYNTHESIS (CHEMISTRY)
Polynuclear aromatic compounds. Synthesis and purification
[PB81-125015] N81-20182
The generalized standard addition method: Intermetallic interferences in anodic stripping voltammetry
[AD-A095419] N81-20222
Survey of electrochemical production of inorganic compounds --- production of synthetic fuels
[ANL/OEPM-80-3] N81-20226
Catalytic synthesis of hydrocarbons over group 8 of the reaction mechanism metals: A discussion
[LBL-11339] N81-20230
SYNTHETIC FUELS
Survey of electrochemical production of inorganic compounds --- production of synthetic fuels
[ANL/OEPM-80-3] N81-20226
Improvements in the electrolytic generation of hydrogen N81-20287
The development of synthetic fuels: Department of Defense logistics implications
[AD-A095713] N81-20290
Review of fusion synfuels
[BNL-28627] N81-20300
Environmetrics of synfuels. 1: Processing the automated PDP-11 data components for the UMD gasifier facility
[ORNL/TM-7428] N81-20305
SYSTEM EFFECTIVENESS
Assessment of training effectiveness N81-20097
SYSTEM FAILURES
Integrating reliability analysis and design
[ALO-131] N81-20449
SYSTEM GENERATED ELECTROMAGNETIC PULSES
Precharge enhanced SGEMP
[AD-A095503] N81-20150
SYSTEMS ANALYSIS
Space Shuttle Program. Mission operation report. *Orbital Flight Test reference document*
[NASA-TM-82321] N81-20164
Sunspace Minnesota: Passive solar design for winter resorts
[DOE/R5-10130/2] N81-20566
Evaluation of solar collectors for heat pump applications
[DOE/CS-35351/T1] N81-20568
An analytic study of a shared device among independent computing systems N81-20755
Space Construction System Analysis. Part 2: Executive summary
[NASA-CR-160902] N81-20797
SYSTEMS ENGINEERING
Total main rotor isolation system analysis
[NASA-CR-165666] N81-20027
Initial design and experimental implementation of the traffic advisory service of ATARS
[AD-A095462] N81-20055
Generalities and definition of a system --- for command and control of satellite attitude and orbit N81-20118
Autonomous spacecraft maintenance study group
[NASA-CR-164076] N81-20168
Optimal risk-based design of water resource engineering projects
[PB81-136202] N81-20316
Design, fabrication and testing of a satellite electron beam system
[AD-A095362] N81-20362
Development of high-temperature turbine subsystem technology to a technology readiness status, phase 2
[FE-1806-96] N81-20440
Critical parameters for coarse coal underground slurry haulage systems
[JPL-PUB-81-11] N81-20495
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 2, appendix A: Selected DSG technologies and their general control requirements
[NASA-CR-164052] N81-20539
Development of components for optical communications with light guiding fibers
[BMFT-FB-T-80-006] N81-20874
Scientific and technical information output of the Langley Research Center for calendar year 1980
[NASA-TM-81950] N81-20949
SYSTEMS INTEGRATION
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG), volume 1
[NASA-CR-164051] N81-20538
SYSTEMS SIMULATION
Synthesis of work concerning eddy current pendular nutation dampers. Application of theory to equipment qualification and verification on a spin simulator
[CNES-78/CT/PRT/SST/SS/197] N81-20169
Magnetic bearing reaction wheel tests --- satellite applications
[CNES-80/CT/PRT/SST/SS/162] N81-20444
Water systems modeling --- solar collectors and heating systems N81-20554
System modeling using TRNSYS computer simulation --- solar heating N81-20555
SYSTOLE
Noninvasive aortic bloodflow by Pulsed Doppler Echocardiography (PDE) compared to cardiac output by the direct Fick procedure N81-20709

T

TABLES (DATA)
Davison AAF, Ft. Belvoir Virginia, Revised Uniform Summary of Surface Weather Observations (RUSSWO), parts A-F
[AD-A095332] N81-20672
Portland IAP, Portland, Oregon, Revised Uniform Summary of Surface Weather Observations (RUSSWO), parts A-F
[AD-A095329] N81-20675
TAIL ASSEMBLIES
Application of linear quadratic control in reduction of aerodynamic forces on aircraft N81-20061
TARGET ACQUISITION
Autonomous acquisition simulator and associated data
[AD-A095709] N81-20145
Comparative tests between TIESPAD and SPA-66 radar display
[AD-A095643] N81-20340
Impact of system errors on TMR processing
[AD-A095382] N81-20348
Image and Sensor Data Processing for Target Acquisition and Recognition
[AGARD-CP-290] N81-20803
An approach to airborne infrared search set performance modeling N81-20805
Teamwork in target Acquisition N81-20808
A TV-tracking system based on computer *intelligence* N81-20816
A system look at real time processing for target acquisition and classification N81-20825
TARGET RECOGNITION
ARI image interpretation research 1970 - 1980
[AD-A095661] N81-20344
Aircraft program for target, background, and sky radiance measurements
[AD-A095363] N81-20646
Image and Sensor Data Processing for Target Acquisition and Recognition
[AGARD-CP-290] N81-20803
The optical contrast of land and sea targets N81-20804
Target detection and classification in infrared imagery N81-20806
Research into methods of image processing for target enhancement and detection N81-20812
A detection and processing scheme for moving *target detection using a passive sensor* N81-20815
Numerical target tracking N81-20817
Target tracking using area correlation N81-20818
A real-time video tracking system based on Bayes rule N81-20819
Target tracking and target detection in TV- and *FLIR-imagery* N81-20820
Target identification of aircraft using IR/TV-sensor-images N81-20821
Autonomous target screeners N81-20822
Evaluation of a realtime prototype automatic target cuer N81-20823
Digital image processing for ground target detection, identification and location N81-20824
Prototype automatic target screener
[AD-A095596] N81-20869
TEAMS
Teamwork in target Acquisition N81-20808
TECHNOLOGICAL FORECASTING
Interplanetary missions: Upcoming technological aspects --- solar sails and solar electric propulsion N81-20138
TECHNOLOGIES
Limitless Horizons. Careers in Aerospace
[NASA-EP-171] N81-20947
The 1981 Budget of the German Federal Ministry for Research and Technology
[NASA-TM-76493] N81-20956
TECHNOLOGY ASSESSMENT
Simulation technology N81-20095
Visual system Technology: Status and problems --- training simulators N81-20099
Launch systems for the 1980's --- their evolution, and prospects for the STS and ARIANE systems N81-20124
Carbon/graphite composite material study
[NASA-CR-164084] N81-20189
Die casting
[PB81-123697] N81-20314
Turbulence measurements in supersonic flows --- hot-wire versus laser anemometry N81-20392
Finned tube heat exchangers: State of the art for the air side
[CONF-800451-3] N81-20399
Development of high-temperature turbine subsystem technology to a technology readiness status, phase 2
[FE-1806-96] N81-20440
Satellite limitations compared to mission *requirements for Earth observation* N81-20512
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 2, appendix A: Selected DSG technologies and their general control requirements
[NASA-CR-164052] N81-20539
Proceedings of the 16th Project Integration Meeting
[NASA-CR-164073] N81-20545
Wind energy resource atlas. Volume 4: The Northeast region
[PNL-3195-WERA-4] N81-20592
High concentration silicon photovoltaic cell development
[SAND-80-7068] N81-20595
TECHNOLOGY TRANSFER
Summary of the western energy overhead monitoring project
[PB81-129009] N81-20531
Beyond the atmosphere: Early years of space science
[NASA-SP-4211] N81-20982
External relations N81-20971
TECHNOLOGY UTILIZATION
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 3, appendix B: State of the art, trends, and potential growth of selected DSG technologies
[NASA-CR-164054] N81-20540
The context --- technological spinoffs from aerospace research N81-20964
Space Science and practical applications N81-20981
TECTONICS
Geology and geochronology of the Halloran Hills, southeastern California, and implications concerning mesozoic tectonics of the southwestern Cordillera N81-20628
TEFLON (TRADEMARK)
Transfer film evaluation for shuttle engine turbopump bearing
[NASA-CR-161672] N81-20425
TELECOMMUNICATION
Shuttle orbiter Ku-band radar/communications system design evaluation
[NASA-CR-160898] N81-20327
Measurements of possible D- and E-region *telecommunications effects during ionospheric heating* --- solar power satellite
[DOE/ER-10161/1] N81-20349

TELEMETRY
Diversity techniques for omnidirectional telemetry coverage of the HIMAT research vehicle
[NASA-TP-1830] N81-20074
Shuttle/payload communications and data systems interface analysis
[NASA-CR-160929] N81-20157

TELEPHONY
Monolithic integrated semiconductor switches with low on-resistance --- for private automatic branch exchange (PABX) applications
[BMFT-FB-T-80-016] N81-20373

TELEVISION CAMERAS
A TV-tracking system based on computer intelligence N81-20816

TELEVISION SYSTEMS
Comparative tests between TIESPAD and SPA-66 radar display
[AD-A095643] N81-20340
Target tracking and target detection in TV- and FLIR-imagery N81-20820
Target identification of aircraft using IR/TV-sensor-images N81-20821
Autonomous target screeners N81-20822

TELEVISION TRANSMISSION
The effect of interference on delta modulation encoded video signals
[NASA-CR-160923] N81-20324

TEMPERATURE
Orbit averaged radial buildup code for tandem mirror geometry
[UCID-18905] N81-20907

TEMPERATURE CONTROL
Study of heat rejection systems --- space shuttle radiator using freon
[TC-80-TR-0054] N81-20165
Energy conservation in houses built from 1960
[SIB-R-4-1980] N81-20589

TEMPERATURE EFFECTS
Test and evaluation of foam-in-place fuel tank container
[AD-A095747] N81-20073
A search for the origin of low temperature anomalies in glasses N81-20922
Temperature dependences of hyperfine fields at SP-impurities in fcc-cobalt studied by nuclear spin precession following heavy-ion reactions N81-20926

TEMPERATURE INVERSIONS
A study of topographically-forced surface winds in Antarctica with special emphasis on the katabatic flow at Adelie Land N81-20655
Analysis of the inversion monitoring capabilities of a monostatic acoustic radar in complex terrain --- Tennessee River Valley
[NASA-CR-3401] N81-20664

TEMPERATURE MEASUREMENT
Measurement of the line reversal temperature of OH in CH4/N2 O flames
[AD-A095349] N81-20408

TEMPERATURE MEASURING INSTRUMENTS
Anomalous visible emission observed from the rear side of laser irradiated thin transparent targets
[AD-A095563] N81-20417

TENDONS
Effect of inaction on function of fast and slow muscle spindles
[NASA-TM-76374] N81-20720

TENNESSEE VALLEY (AL-KY-TN)
Analysis of the inversion monitoring capabilities of a monostatic acoustic radar in complex terrain --- Tennessee River Valley
[NASA-CR-3401] N81-20664

TENSILE CREEP
Mechanisms of elevated temperature rupture in single phase ceramics
[DOE/ER-10591/1] N81-20280

TENSILE PROPERTIES
Plastic analysis of randomly distributed grains in a tensile specimen
[SAND-80-2780] N81-20473

TENSILE TESTS
Determination of load sequence effects on the degradation and failure of composite materials --- Graphite-epoxy composites
[NASA-CR-164065] N81-20186
Simultaneous stress relaxation in tension and creep in torsion of 2618 aluminum at elevated temperature
[AD-A095410] N81-20248

TENSORS
Infrared intensities of alcohols and ethers N81-20197

TEPHIGRAMS
Physical and chemical characteristics of Mt. St. Helens airborne debris
[LA-UR-81-110] N81-20613

TERMINAL CONFIGURED VEHICLE PROGRAM
A pilot training manual for the terminal configured vehicle electronic horizontal situation indicator
[NASA-TM-81959] N81-20044
Operational considerations in utilization of microwave landing system approach and landing guidance
[NASA-TM-81945] N81-20050

TERMINAL GUIDANCE
Design of a fuel-efficient guidance system for a STOL aircraft
[NASA-TM-81256] N81-20006

TERRAIN
Atmospheric Studies in Complex Terrain (ASCOT) information survey
[UCID-18572] N81-20615
Comparison of wind spectra from spatially averaged and point measurements in complex terrain
[UCRL-84546] N81-20678

TERRAIN ANALYSIS
Orthophotography and numerical terrain models --- of aerial imagery N81-20506
Applied research in analytical photogrammetry
[PB81-127300] N81-20530
Coastal remote sensing investigations. Volume 2: Beach environment
[AD-A095692] N81-20688
On the use of hierarchically computed 'Mexican Hat' features for texture discrimination
[AD-A095718] N81-20792

TEST CHAMBERS
Comments on settling chamber design for quiet, blowdown wind tunnels
[NASA-TM-81948] N81-20085

TEST FACILITIES
Jet Propulsion Laboratory: Outsider or insider? N81-20977

TETHERLINES
Study of certain launching techniques using long orbiting tethers
[NASA-CR-164060] N81-20107

TEXTURES
On the use of hierarchically computed 'Mexican Hat' features for texture discrimination
[AD-A095718] N81-20792

THEMATIC MAPPING
ICAP: An Interactive Cluster Analysis Procedure for analyzing remotely sensed data --- to classify the radiance data to produce a thematic map
[NASA-TM-80732] N81-20494
Processing radiometric data for cartography N81-20518

THEOREM PROVING
A proof of the existence of unstable periodic orbits using computer-based techniques N81-20770

THERMAL ABSORPTION
Development of method and equipment for energy recovery from the exhaust gases of the oil-fueled smelting and holding furnaces
[STU-78-6895] N81-20573
Study of the effectiveness of selective absorber coatings and phase change materials in passive solar space heating
[LA-UR-80-2930] N81-20936

THERMAL BATTERIES
Reaction rates of atmospheric gases with Lithium (Silicon) alloy
[SAND-80-1363] N81-20234

THERMAL BOUNDARY LAYER
The aerospace thermal model (HFLUX): Its structure and utility
[AD-A095359] N81-20397

THERMAL CONDUCTIVITY
A heat pulse study of superconducting lead/indium alloys N81-20921

THERMAL DEGRADATION
Fourier transform infrared spectroscopic studies on the thermal degradation of polyacrylonitrile copolymers
[AD-A095270] N81-20277

THERMAL EMISSION
The nature of the spatial structure of diffuse soft X-rays in the direction of the North Polar Spur N81-21004

THERMAL ENERGY
Energy out of groundwater
[NE/HETV-80/9] N81-20565

THERMAL FATIGUE
Some effects of thermal-cycle-induced deformation in rocket thrust chambers
[NASA-TP-1834] N81-20176

THERMAL INSULATION
Optimal distribution of thermal insulation and ground heat losses
[PB81-122871] N81-20317

THERMAL MAPPING
The aerospace thermal model (HFLUX): Its structure and utility
[AD-A095359] N81-20397

THERMAL RADIATION
Ignition of a liquid fuel under high intensity radiation
[AD-A095691] N81-20223

THERMAL STABILITY
The retardation of crystallization of CVD amorphous silicon and the study of its structural and optical properties N81-20912

THERMAL STRESSES
MHD air heater development technology
[DOE/ET-15602/T2] N81-20590

THERMIONIC CONVERTERS
Advanced theoretical methods for improving the performance of thermionic converters --- Boltzmann equation solutions
[DOE/ET-15422/5] N81-20560

THERMOCHEMICAL PROPERTIES
Latent and chemical storage --- solar energy, thermochemical storage N81-20550

THERMOCOUPLES
Detection of water induction in steam turbines
[EPRI-CS-1604] N81-20438

THERMODYNAMIC CYCLES
High-reliability gas turbine combined-cycle development program, phase 1. Volume 2: Appendixes
[EPRI-AP-1599-VOL-2] N81-20434

THERMODYNAMIC PROPERTIES
Selected physical and thermal properties of various formulations of silicone potting compounds
[MHSMP-80-63] N81-20235
Boundary-layer structure over the tropical ocean N81-20683
GIRL: German Infrared Laboratory. Telescope study, phase B
[NASA-TM-75911] N81-20866
Structural and thermodynamic properties of xenon, krypton, and argon adsorbed on silver(111) N81-20924
Calculation of the thermodynamic properties of fuel-vapor species from spectroscopic data
[ANL-CEN-RSD-80-2] N81-20943

THERMOELECTRICITY
The electrical resistivity and the thermoelectric ratio of potassium and dilute potassium rubidium alloys below 1 K N81-20919

THERMONUCLEAR POWER GENERATION
Approach to ignition of Tokamak reactors
[ORNL/TM-7552] N81-20897
Neoclassical current effects in neutral beam-heated Tokamaks
[ORNL/TM-7611] N81-20899
Massachusetts Institute of Technology, Plasma fusion center, technical research programs
[DOE/ET-52002/T1] N81-20900
Charged-particle cross section data for fusion plasma applications
[COO-2218-195] N81-20902

THERMOPHYSICAL PROPERTIES
Investigation of fabrication, composition and properties of new high temperature ceramics based on silicon nitride
[BMFT-FB-T-79-174] N81-20283

THERMOPLASTIC RESINS
Graphite composite truss welding and cap section forming subsystems. Volume 2: Program results
[NASA-CR-160932] N81-20463

THERMOREGULATION
Role of a decrease in body heat content in the thermoregulatory reaction of the concha auriculae vessels
[NASA-TM-76370] N81-20717

THETA PINCH
Electron heating in a high voltage toroidal theta pinch N81-20884
Axial shock wave heating of reversed-field theta-pinch plasmas
[MSNW-81-1158-1] N81-20908

THICK FILMS
Development of hybrid circuits --- based on thick film technology
[DH-RS-01] N81-20374

THICKENERS (MATERIALS)
An experimental device for measurement of the viscoelastic properties of thickened liquids
[AD-A095396] N81-20225

THIN FILMS
Tantalum aluminum thin film technology for a new generation of microwave integrated circuit applications --- selective etching process control
[BMFT-FB-T-80-015] N81-20372
Thin film strain transducer --- in-flight measurement of stress or strain in walls of high altitude balloons
[NASA-CR-156875] N81-20406
Sputtering and ion plating for aerospace applications
[NASA-TM-81726] N81-20424
Transfer film evaluation for shuttle engine turbopump bearing
[NASA-CR-161672] N81-20425
Low cost, sprayed CdTe solar cell research
[SERI/PR-8104-3-T2] N81-20585
Materials and methods for the development of solar energy --- thin film cells
[BMFT-FB-T-80-065] N81-20601
Integrated thin-film light modulation lines and matrices
[BMFT-FB-T-80-013] N81-20877
Structural and thermodynamic properties of xenon, krypton, and argon adsorbed on silver(111)
N81-20924

THORIUM
Calculation of the thermodynamic properties of fuel-vapor species from spectroscopic data
[ANL-CEN-RSD-80-2] N81-20943

THREE AXIS STABILIZATION
Attitude and orbit command --- guidance with spin stabilization or three axis stabilization N81-20119

THREE BODY PROBLEM
Orbits near triple collision in the three body problem N81-20769

THREE DIMENSIONAL FLOW
Theoretical studies of three dimensional transonic flow through a compressor blade row
[AD-A095707] N81-20035
A three-dimensional turbulent compressible subsonic duct flow analysis for use with constructed coordinate systems
[NASA-CR-3389] N81-20383

THRUST
Extended operating range of the 30-cm ion thruster with simplified power processor requirements
[NASA-TM-81729] N81-20179

THRUST CHAMBERS
Some effects of thermal-cycle-induced deformation in rocket thrust chambers
[NASA-TP-1834] N81-20176

THRUST CONTROL
Actuators --- for spacecraft applications
N81-20121

THRUST PROGRAMMING
Using the ARIANE launch vehicle N81-20125

THUNDERSTORMS
Thundercloud local electric field intensification during the pre-breakdown phase of lightning --- time and space evolution N81-20657
The 1980 direct strike lightning data
[NASA-TM-81946] N81-20868

THYMUS GLAND
Comparison of early reactions of the blood system in rats to immobilization, the action of hypoxia and the administration of erythropoietin
[NASA-TM-76169] N81-20699

THYRATRONS
High voltage, low inductance hydrogen thyratron study program
[AD-A095278] N81-20364

TILT ROTOR AIRCRAFT
Recent progress in V/STOL aircraft technology
[NASA-TM-81281] N81-20066

TIME DEPENDENCE
Time-dependent convection N81-20993

TIME DIVISION MULTIPLEXING
Ultra low loss optical fiber cable assemblies
[AD-A095551] N81-20870

TIME SERIES ANALYSIS
Identification of jet engine damages by engine trend analysis LEADS 200 data N81-20014
LORI: A multisatellite, multisystem, time-coverage analysis program
[AD-A095537] N81-20148

TIN ALLOYS
Effects of strain on the superconducting properties of niobium-tin conductors
[UCRL-53069] N81-20368

TIROS N SATELLITE
Methods of localization by satellites in the ARGOS system N81-20134

TISSUES (BIOLOGY)
The effect of immobilization and 3 (beta-aminoethyl)-1, 2, 4 triazol on the calcium content in gastric tissues of guinea pigs during the formation of experimental ulcers
[NASA-TM-75992] N81-20691
Multifunctional transducer
[NASA-CASE-NPO-14329-1] N81-20703
Hypoxia in the walls of large blood vessels
N81-20706

TITANIUM ALLOYS
Effects of geometric variables on rub characteristics of Ti-6Al-4V
[NASA-TP-1835] N81-20245
Metallurgical characterization of superplastic forming
[AD-A095720] N81-20255
Investigation into the behavior of titanium and titanium alloys under cavitational stress --- droplet impinger
[GEC-TRANS-2071] N81-20265
Turbine materials characteristics under low cycle fatigue --- turbine engine disk life
[BMFT-FB-T-79-151] N81-20268
Crack propagation in electron beam welded Ti-6Al-4 under spectrum loading conditions
[AD-A095585] N81-20467

TOKAMAK DEVICES
A study of impurity transport with an EUV spatial imaging detector system on the Alcator A Tokamak N81-20878
Ion heating in the ion cyclotron range of frequencies in the Wisconsin Tokapole 2 N81-20880
Impact of plasma wall interactions on the burn dynamics of Tokamak reactors N81-20883
Approach to ignition of Tokamak reactors
[ORNL/TM-7552] N81-20897
Neoclassical current effects in neutral beam-heated Tokamaks
[ORNL/TM-7611] N81-20899
Fusion studies program
[DOE/ET-52025/3] N81-20906

TOLERANCES (PHYSIOLOGY)
Specialized physiological studies in support of manned space flight
[NASA-CR-160936] N81-20707
Tolerance of Lower Body Negative Pressure (LBNP) in endurance runners, weightlifters, swimmers and nonathletes N81-20708

TOLUENE
A study of gas solid reactions and air pollution detectors
[AD-A095253] N81-20610

TOPOGRAPHY
A watershed information system
[PB81-127433] N81-20528
Atmospheric Studies in Complex Terrain (ASCOT) information survey
[UCID-18572] N81-20615
Propagation of traffic noise
[PB81-123523] N81-20619
Analogs of Martian eolian features in southwestern Egypt N81-20640
Comparison of observed and predicted slope winds
[PNL-SA-8785] N81-20679

TOROIDAL PLASMAS
Energy principle with global invariants --- equilibria in toroidal plasmas N81-20879
Electron heating in a high voltage toroidal theta pinch N81-20884
Formation of compact toroidal plasmas by magnetized coaxial plasma gun injection into an oblate flux conserver
[UCRL-85122] N81-20895
Physical properties of compact toroids generated by a coaxial source
[LA-UR-80-3238] N81-20896
Ideal MHD equilibrium of a weakly toroidal plasma column with elongated cross section. Part 2: Force-free fields
[REPT-80-124-PT-2] N81-20911

TORSION
A spin coefficient approach to Weyssenhoff fluids in Einstein-Cartan theory
[MATH-RES-153] N81-20801
A Newman-Penrose type formalism for space-times with torsion. Part 2: Exact plane wave solutions
[MATH-RES-143-PT-2] N81-20944

TORSIONAL STRESS
Simultaneous stress relaxation in tension and creep in torsion of 2618 aluminum at elevated temperature
[AD-A095410] N81-20248
Numerical procedure for predicting the torsional dynamic response of solid media N81-20460

TOUGHNESS
Toughening of epoxy resin by acrylic elastomer
N81-20273

TOXIC HAZARDS
Carbon/graphite composite material study
[NASA-CR-164084] N81-20189
Gas chromatography of polybrominated biphenyls utilizing electron capture detection N81-20199

TRACE CONTAMINANTS
Characterization of the physico-chemical properties of polymeric materials for aerospace flight --- differential thermal and atomic absorption spectroscopic analysis of nickel cadmium batteries
[NASA-CR-164062] N81-20276

TRACE ELEMENTS
Solvent Refined Coal (SRC) process: Trace elements research and development. Volume 3: Pilot plant development work, part 6: The fate of trace elements in the SRC process
[DOE/ET-10104/T11] N81-20308

TRACKING (POSITION)
Error analysis and performance data from an automated azimuth measuring system
[AD-A095448] N81-20057
A TV-tracking system based on computer intelligence N81-20816
Numerical target tracking N81-20817
Target tracking using area correlation N81-20818
A real-time video tracking system based on Bayes rule N81-20819
Target tracking and target detection in TV- and FLIR-imagery N81-20820
Target identification of aircraft using IR/TV-sensor-images N81-20821
Digital image processing for ground target detection, identification and location N81-20824

TRACTION
Life analysis of multiroller planetary traction drive
[NASA-TP-1710] N81-20423

TRAFFIC
Propagation of traffic noise
[PB81-123523] N81-20619

TRAFFIC CONTROL
Standard software base release 3 --- communication systems applications
[AD-A095693] N81-20749

TRAINING EVALUATION
Assessment of training effectiveness N81-20097

TRAINING SIMULATORS
Fidelity of simulation for pilot training
[AGARD-AR-159] N81-20091
Fidelity of simulation for pilot training. Introduction N81-20092
Pilot training N81-20093
Physiological factors N81-20094
Simulation technology N81-20095
Conclusions and recommendations --- training simulator requirements and objectives N81-20096
Assessment of training effectiveness N81-20097
Pilot assessment of Training simulators N81-20098
Visual system Technology: Status and problems --- training simulators N81-20099

TRAJECTORIES
The semi-operational evaluation of the trajectory prediction method for Signal Automatic Radar Processing (SARP) 2 --- air traffic control
[NLR-MP-79038-U] N81-20059
TRAJECTORY ANALYSIS
Design of a fuel-efficient guidance system for a STOL aircraft
[NASA-TM-81256] N81-20006
Space and time reference systems N81-20111
Orbit determination: Statistical methods N81-20116
The calculation of interplanetary trajectories --- for spacecraft N81-20136
Models of the upper Earth atmosphere. Application to satellite trajectory determination N81-20139
Analyses of the US Navy orbits of 1963-24B and 1974-34A at 15th order resonance
[RAE-TR-80093] N81-20142
Dynamic spatial geodesy --- to determine the Earth's gravitational field by satellite trajectory analysis N81-20499
TRAJECTORY MEASUREMENT
Measurement for orbit determination --- comparison of ground based satellite position observation techniques N81-20115
TRAJECTORY OPTIMIZATION
Optimum maneuvers of supersonic aircraft, volumes 1 and 2 N81-20060
TRANSCONTINENTAL SYSTEMS
Satellite-aided mobile communications limited operational test in the trucking industry
[NASA-CR-166658] N81-20337
TRANSDUCERS
Multifunctional transducer
[NASA-CASE-NPO-14329-1] N81-20703
TRANSFER FUNCTIONS
Dynamics of cavitating cascades --- transfer functions
[NASA-CR-161673] N81-20382
TRANSFER ORBITS
Study of certain launching techniques using long orbiting tethers
[NASA-CR-164060] N81-20107
TRANSIENT LOADS
Building thermal loads calculations N81-20557
TRANSIENT RESPONSE
Extended frequency turbofan model
[NASA-CR-165261] N81-20078
Silent boundary methods for transient wave analysis N81-20378
TRANSISTOR CIRCUITS
The calculation of the current-gain of bipolar transistors and the theory for the forward-biased p-n junction at all injection levels N81-20354
TRANSITION METALS
Conductivity as a tool for evaluating the homogeneity of sintered discs of transition metal oxides
[AD-A095298] N81-20249
Preparation of high purity vanadium
[IS-M-305] N81-20262
TRANSITION PROBABILITIES
Atomic inner-shell processes
[AD-A095415] N81-20837
TRANSLATING
Data format translation routines
[ORNL/CSD/TM-137] N81-20752
TRANSMISSION CIRCUITS
Payloads minimum EIRP formulations N81-20161
TRANSMISSION LINES
Design, construction and testing of a dc bioeffects test enclosure for small animals --- simulating the environment of high voltage dc transmission lines
[DOE/RA-10157/1] N81-20702
Psychoacoustic evaluation of transmission line audible noise: Building attenuation effects, methodology comparison, and field study feasibility, volume 1
[DOE/RA-29323/1] N81-20833
Exploratory development model hermaphroditic fiber optic connectors
[AD-A095276] N81-20871
TRANSONIC FLOW
Transonic flow past projectiles with variable nonaxisymmetric cross section
[AD-A095376] N81-20033
Theoretical studies of three dimensional transonic flow through a compressor blade row
[AD-A095707] N81-20035
An application of the embedded grid technique to the calculation of transonic flow past wings --- Cartesian grids and programming
[FFA-TN-AU-1600] N81-20036
A panel method to determine loads on oscillating airfoils in transonic flow with embedded shock waves
[NLR-MP-80005-U] N81-20039
TRANSONIC WIND TUNNELS
Two-dimensional adaptive-wall experiments
[AD-A095199] N81-20087
National Transonic Facility: A review of the operational plan
[PB81-115289] N81-20090
TRANSPONDERS
Development of a parametric amplifier for satellite transponder applications at 14 to 14.5 GHz
[BMFT-FB-W-79-27] N81-20375
TRANSPORT AIRCRAFT
Issues of commonality. Volume 2: Issue analysis
[AD-A095418] N81-20046
Application of linear quadratic control in reduction of aerodynamic forces on aircraft N81-20061
Integrated Application of Active Controls (IAAC) technology to an advanced subsonic transport: Project plan
[NASA-CR-3305] N81-20062
Stress analysis of aircraft modifications (C-141B Aircraft). Joint Airborne Communications Center/Command Post (JACC/CP) provisions
[AD-A095634] N81-20072
An analytical study of the longitudinal response of airplanes to positive wind shear
[NASA-TP-1765] N81-20082
Development and validation of cryogenic foam insulation for LH2 subsonic transports
[NASA-CR-3404] N81-20312
TRANSPORT PROPERTIES
Comparative adsorption performance of synthetic absorbents and activated carbons N81-20215
Experimental and theoretical investigations on the influence of shear in double diffusive convection N81-20376
A unified theory of linear diffusion in multilayered materials N81-20381
Experimental and theoretical studies of donor-type graphite intercalated compounds
[AD-A095282] N81-20935
TRANSPORT THEORY
Turbulence transport models for numerical computation of complex turbulent flows N81-20386
A simple static photochemical transport model for application to the upper atmospheres of Earth, Mars and Venus
[BMFT-FB-W-79-35] N81-20650
Collocation method for the solution of the neutron transport equation with both symmetric and asymmetric scattering
[SAND-80-1446] N81-20843
Approach to ignition of Tokamak reactors
[ORNL/TM-7552] N81-20897
Neoclassical current effects in neutral beam-heated Tokamaks
[ORNL/TM-7611] N81-20899
TRANSPORTATION
Satellite-aided mobile communications limited operational test in the trucking industry
[NASA-CR-166658] N81-20337
TRANSPORTATION ENERGY
Integrated Application of Active Controls (IAAC) technology to an advanced subsonic transport: Project plan
[NASA-CR-3305] N81-20062
TRAVELING SALESMAN PROBLEM
The traveling salesman (0,2) matchings
[AD-A095716] N81-20775
TRAVELING WAVE TUBES
High power amplifier 14 GHz for satellite ground stations
[BMFT-FB-T-79-158] N81-20370
TRAVELING WAVES
Concepts and limitations of macroparticle accelerators using traveling magnetic waves
[LA-UR-80-3507] N81-20860
TRIGGER CIRCUITS
High voltage, low inductance hydrogen thyratron study program
[AD-A095278] N81-20364
TRIODES
Controlled avalanche transit-time triode amplifiers N81-20353
TROPICAL REGIONS
Boundary-layer structure over the tropical ocean N81-20683
TROPICAL STORMS
Upper tropospheric cyclonic vortices in the tropical South Atlantic
[INPE-1946-RPE/263] N81-20660
TROPOSPHERE
The President's Day cyclone 17-19 February 1979: An analysis of jet streak interactions prior to cyclogenesis
[NASA-TM-82077] N81-20658
Balloon Electrical Environment Profiling System (BEEPS)
[AD-A095531] N81-20669
TRUCKS
Satellite-aided mobile communications limited operational test in the trucking industry
[NASA-CR-166658] N81-20337
TRUSSES
Graphite composite truss welding and cap section forming subsystems. Volume 1: Executive summary --- large space structures
[NASA-CR-160933] N81-20462
TUBE GRIDS
The 200 kV linear beam switch tube development
[AD-A095505] N81-20363
TUBE HEAT EXCHANGERS
Finned tube heat exchangers: State of the art for the air side
[CONF-800451-3] N81-20399
TUNABLE LASERS
Development of combustion diagnostics and application to turbulent combustion
[AD-A095719] N81-20219
TUNING
Direct narrow line tuning of a high power CO2 laser
[PPPL-1736] N81-20421
TURBINE BLADES
Examination of the strength of high temperature alloys for gas turbines in hot gas environments
[BMFT-FB-T-79-150] N81-20267
Steam turbines for large power outputs N81-20427
Blade vibration excitation and sound generation by flow nonuniformities N81-20429
TURBINE ENGINES
Reasons for low aerodynamic performance of 13.5-centimeter-tip-diameter aircraft engine starter turbine
[NASA-TP-1810] N81-20076
Turbine materials characteristics under low cycle fatigue --- turbine engine disk life
[BMFT-FB-T-79-151] N81-20268
Analytical design of an advanced radial turbine --- automobile engines
[NASA-CR-165170] N81-20958
TURBINE PUMPS
Dynamics of cavitating cascades --- transfer functions
[NASA-CR-161673] N81-20382
Transfer film evaluation for shuttle engine turbopump bearing
[NASA-CR-161672] N81-20425
TURBOCOMPRESSORS
Some effects of compressor fouling on the behavior of a turbojet engine --- as evidenced by an engine monitoring system N81-20015
TURBOFAN AIRCRAFT
Recent progress in V/STOL aircraft technology
[NASA-TM-81281] N81-20066
TURBOFAN ENGINES
Concept definition: Retirement for cause of F-100 rotor components
[AD-A095584] N81-20080
TURBOFANS
Extended frequency turbofan model
[NASA-CR-165261] N81-20078
TURBOGENERATORS
Field turbine tests --- of large steam turbine generator units N81-20431
TURBOJET ENGINES
Some effects of compressor fouling on the behavior of a turbojet engine --- as evidenced by an engine monitoring system N81-20015

Aerodynamic characteristics of a hypersonic cruise aircraft concept with wing-mounted propulsion systems at Mach numbers of 2.96, 3.96 and 4.63 --- Langley unitary plan wind tunnel tests
[NASA-TM-81937] N81-20025

TURBOMACHINE BLADES
Experimental development of bladings for large steam turbines N81-20433

TURBULENCE
Application of linear quadratic control in reduction of aerodynamic forces on aircraft N81-20061
Development of combustion diagnostics and application to turbulent combustion
[AD-A095719] N81-20219
HC quench layer formation in combustion processes
[DOE/ET-15303/T5] N81-20236
Physical arguments and experimental evidence in support of the mesolayer theory of turbulence N81-20377
Turbulence measurements in supersonic flows --- hot-wire versus laser anemometry N81-20392

TURBULENCE EFFECTS
The influence of turbulence on combustion in open pre-mixed flames N81-20198

TURBULENCE METERS
Hot wire techniques: Conditional sampling and intermittency --- measurement of turbulent flows N81-20393

TURBULENT BOUNDARY LAYER
Subsonic axisymmetric base flow control using boundary layer thickness and near-wake mass balance variations N81-20024
Physical arguments and experimental evidence in support of the mesolayer theory of turbulence N81-20377
Computation of unsteady turbulent boundary layers with flow reversal and evaluation of two separate turbulence models
[NASA-TM-81259] N81-20384
Optical measurements of the diffusion of a heavy gas in turbulent boundary layer --- inside a wind tunnel N81-20391
Measurements of a separating turbulent boundary layer
[AD-A095252] N81-20394
Measurements of the transverse velocity of a separating turbulent boundary layer --- wind tunnel tests
[AD-A095256] N81-20395

TURBULENT DIFFUSION
A study of dispersion processes and climatology from the TWERL Balloon experiment N81-20022
Measurements and predictions of complex turbulent flows, volume 2 --- conference, Belgium, 11-15 Feb. 1980
[VKI-LS-1980-3-VOL-2] N81-20385
On the motions of particles in turbulent flows --- pipe flow N81-20389
Oscillating grid turbulence, including the effects of rotation N81-20881

TURBULENT FLOW
Comments on settling chamber design for quiet, blowdown wind tunnels
[NASA-TM-81948] N81-20085
A three-dimensional turbulent compressible subsonic duct flow analysis for use with constructed coordinate systems
[NASA-CR-3389] N81-20383
Measurements and predictions of complex turbulent flows, volume 2 --- conference, Belgium, 11-15 Feb. 1980
[VKI-LS-1980-3-VOL-2] N81-20385
Turbulence transport models for numerical computation of complex turbulent flows N81-20386
High speed velocity measurements using laser-Doppler anemometers --- application to turbulent fluid flows and measurement optimization N81-20388
On the motions of particles in turbulent flows --- pipe flow N81-20389
Hot wire techniques: Conditional sampling and intermittency --- measurement of turbulent flows N81-20393

TURBULENT MIXING
Turbulent mixing and concentration measurement --- in nozzle flows N81-20390

TWO BODY PROBLEM
Orbit perturbations: The effects --- elliptical orbits N81-20113

TWO DIMENSIONAL BODIES
Extended frequency turbofan model
[NASA-CR-165261] N81-20078

TWO DIMENSIONAL FLOW
MARIAH: A finite element computer program for incompressible porous flow problems
[SAND-79-1623] N81-20402

TWO PHASE FLOW
Nonequilibrium effects in wet-steam turbines N81-20430

TWO STAGE TURBINES
Flow in a 320 MW low-pressure section: Theoretical and experimental evaluation --- of the steam fluid dynamic behavior and turbine performance N81-20432

U

U.S.S.R.
Change in energy expenditure and brain and adrenal content of catecholamines in rats during muscular loading and hypokinesia
[NASA-TM-76148] N81-20697
Effect of six-month hypokinesia in dogs on mineral component, reconstruction and mechanical properties of bone tissue
[NASA-TM-76168] N81-20698
Comparison of early reactions of the blood system in rats to immobilization, the action of hypoxia and the administration of erythopoietin
[NASA-TM-76169] N81-20699
Preliminary results of scientific research on biosatellite Kosmos-1129
[NASA-TM-76287] N81-20700
Effect of inaction on function of fast and slow muscle spindles
[NASA-TM-76374] N81-20720

ULTRAHIGH FREQUENCIES
Combination of integrated injection logic (IIL) for UHF analog circuitry
[BMFT-FB-T-80-010] N81-20371

ULTRAPURE METALS
Ultrapure metals preparation in space
[NASA-CR-161678] N81-20101
Preparation of high purity vanadium
[IS-M-305] N81-20262

ULTRASONIC RADIATION
Ultrasonic attenuation in normal and superconducting indium N81-20918

ULTRASONIC TESTS
Ultrasonic Materials Characterization
[PB81-124984] N81-20412
Computer techniques for ultrasonic inspection
[AD-A095285] N81-20447

ULTRASONIC WAVE TRANSDUCERS
Ultrasonic imaging with narrow beam insonification across a fluid-metal interface N81-20827

ULTRASONIC WELDING
Ultrasonic weld sealing of M55 stab detonators
[AD-A095343] N81-20436
Graphite composite truss welding and cap section forming subsystems. Volume 1: Executive summary --- large space structures
[NASA-CR-160933] N81-20462
Graphite composite truss welding and cap section forming subsystems. Volume 2: Program results
[NASA-CR-160932] N81-20463

ULTRASONICS
Detection of water induction in steam turbines
[EPRI-CS-1604] N81-20438

ULTRAVIOLET LASERS
Ultraviolet laser photochemistry of halogenated methanes
[LA-UR-80-2798] N81-20233

ULTRAVIOLET RADIATION
Degradation of the surface finish of the SPACELAB pallet after ultraviolet irradiation --- paints
[ESA-STM-215] N81-20284
Ultraviolet photodissociation of molecular beams
[AD-A095472] N81-20835
Single photon excimer laser photodissociation of highly vibrationally excited polyatomic molecules
[LA-UR-80-3459] N81-20847
Ultraviolet phase conjugation and its practical implication
[LA-UR-80-3621] N81-20873

UNCONTROLLED REENTRY (SPACECRAFT)
Natural reentry of satellites: SKYLAB --- orbit calculations N81-20141
The reentry of SKYLAB: Reentry tracking and orbit calculation
[CNES-CT/EMT/MT/MS/208] N81-20143

UNCOUPLED MODES
Damping synthesis for ARIANE payload coupled analyses
[CNES-79/CT/PRT/SST/SM/331] N81-20155

UNDERGROUND STORAGE
Radioactive waste storage in mined caverns in crystalline rock: Results of field investigations at Stripa, Sweden
[LBL-11651] N81-20857

UNDERWATER ACOUSTICS
Quantitative schlieren analysis of acoustic interaction with submerged plates N81-20828

UNIFORM FLOW
Boundary layer effects on an acoustic field N81-20826

UNIVERSITIES
The universities: Allies and rivals to NASA N81-20975

UNMANNED SPACECRAFT
With the solaris project CNES proposes to the Europeans the construction of an entirely automatic space laboratory
[NASA-TM-76492] N81-20144
Rockets and spacecraft: Sine qua non of space science N81-20972

UNSTEADY FLOW
Unsteady airloads on a harmonically pitching wing with external store
[NLR-MP-80004-U] N81-20038
Dynamics of cavitating cascades --- transfer functions
[NASA-CR-161673] N81-20382
Computation of unsteady turbulent boundary layers with flow reversal and evaluation of two separate turbulence models
[NASA-TM-81259] N81-20384

UPPER ATMOSPHERE
Models of the upper Earth atmosphere. Application to satellite trajectory determination N81-20139
A simple static photochemical transport model for application to the upper atmospheres of Earth, Mars and Venus
[BMFT-FB-W-79-35] N81-20650
The Academy of Sciences stakes a claim N81-20967
Early harvest: The upper atmosphere and cosmic rays N81-20968

UPWELLING WATER
Some large scale aspects of the Southern Ocean and its environment N81-20685

URANIUM
Calculation of the thermodynamic properties of fuel-vapor species from spectroscopic data
[ANL-CEN-RSD-80-2] N81-20943

URBAN PLANNING
Water resource priorities for the midwest --- Ohio, Indiana, Illinois, Michigan, Minnesota, Wisconsin, and Iowa
[PB81-129801] N81-20315

URBAN RESEARCH
Modified factor analysis of selected RAPS (Regional Air Pollution Study) aerosol data --- St. Louis, Missouri area
[PB81-120784] N81-20622

URBAN TRANSPORTATION
Energy emergency contingency plan
[PB81-128704] N81-20604
Intercity, bus, rail, and air service for residents of rural areas
[PB81-120826] N81-20961

USER MANUALS (COMPUTER PROGRAMS)
MARIAH: A finite element computer program for incompressible porous flow problems
[SAND-79-1623] N81-20402
SPIDA: A small program for interactive display and analysis --- stress analysis and heat transfer
[REL/R(79)28] N81-20476
The 3D solid element (type 4 - elastic or elastic-perfectly-plastic) for the ANSR-11 program --- nonlinear structural response
[PB81-123242] N81-20485

USER REQUIREMENTS
National Transonic Facility: A review of the operational plan
[PB81-115289] N81-20090
Fidelity of simulation for pilot training
[AGARD-AR-159] N81-20091

Fidelity of simulation for pilot training. Introduction N81-20092
Pilot training N81-20093
Conclusions and recommendations --- training simulator requirements and objectives N81-20096
Assessment of training effectiveness N81-20097
Using the ARIANE launch vehicle N81-20125

UTAH
Summary of the western energy overhead monitoring project
[PB81-129009] N81-20531

UTILITIES
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 5, appendix D: Cost-benefit considerations for providing dispersed storage and generation for electric utilities
[NASA-CR-164053] N81-20542

V

V/STOL AIRCRAFT
Experimental investigations on the V/STOL tunnel at NASA/Langley Research Center
[NASA-CR-165655] N81-20028
Recent progress in V/STOL aircraft technology
[NASA-TM-81281] N81-20066
Naval structural materials: Requirements, issues, and opportunities
[AD-A095724] N81-20466

VACUUM EFFECTS
Ultrapure metals preparation in space
[NASA-CR-161678] N81-20101

VACUUM MELTING
Interaction between computational modelling and experiments for vacuum consumable arc remelting
[SAND-80-1177C] N81-20257

VALENCE
Experimental and theoretical studies of donor-type graphite intercalated compounds
[AD-A095282] N81-20935

VANADIUM
Effects of hydrogen on the elastic constants of vanadium and palladium single crystals N81-20242
Preparation of high purity vanadium
[IS-M-305] N81-20262

VANADIUM ALLOYS
Effects of geometric variables on rub characteristics of Ti-6Al-4V
[NASA-TP-1835] N81-20245
Microstructure and properties of A15 superconductors formed by direct precipitation
[LBL-11605] N81-20367

VANGUARD SATELLITES
Deepening perspective: A new look at the old world --- satellites and the earth sciences N81-20973

VAPOR DEPOSITION
The retardation of crystallization of CVD amorphous silicon and the study of its structural and optical properties N81-20912

VAPOR PHASES
Plasma chemistry for inorganic materials
[NASA-TM-75844] N81-20889

VAPORS
Consultation for the H2S and meteorological monitoring program of the Ente Nazional per l'Energia Elecrtrica (ENEL)
[DOE/ET-28502/1] N81-20680

VARIATIONS
Plasma fluctuation measurements in ELMO Bumpy Torus
[ORNL/TM-7530] N81-20898

VASOCONSTRICTION
Role of a decrease in body heat content in the thermoregulatory reaction of the concha auriculae vessels
[NASA-TM-76370] N81-20717

VECTOR SPACES
The closeness of uniform random points in a square and a circle
[AD-A095697] N81-20772
Continuity of the optimal value function under the Mangasarian-Fromovitz Constraint Qualification
[AD-A095422] N81-20800

VECTORS (MATHEMATICS)
A general dynamic synthesis for complex structures composed of substructures N81-20455

VEGETATION
A watershed information system
[PB81-127433] N81-20528
Propagation of traffic noise
[PB81-123523] N81-20619

VELOCITY DISTRIBUTION
Experimental investigations on the V/STOL tunnel at NASA/Langley Research Center
[NASA-CR-165655] N81-20028
The velocity induced by the wake of a wind turbine in a shear layer, including ground effect
[FFA-133] N81-20037

VELOCITY MEASUREMENT
High speed velocity measurements using laser-Doppler anemometers --- application to turbulent fluid flows and measurement optimization N81-20388
Turbulence measurements in supersonic flows --- hot-wire versus laser anemometry N81-20392

VENUS ATMOSPHERE
A simple static photochemical transport model for application to the upper atmospheres of Earth, Mars and Venus
[BMFT-FB-W-79-35] N81-20650

VERTICAL AIR CURRENTS
Longitudinal differences in the spread F characteristics in the American zone and implications on the F-region dynamo
[INPE-1941-RPE/260] N81-20635
Wind profiles for Space Shuttle loads analysis
[NASA-CR-161676] N81-20666

VERTICAL DISTRIBUTION
Atmospheric ozone measurements in Brazil data bulletin no. 1, 1974 - 1976
[INPE-1985-RPE/282] N81-20663

VERTICAL MOTION
A short note on AIDS and windshear: British airways experience --- with a modified vertical speed indicator N81-20012

VERTICAL PERCEPTION
Characteristics of vestibulosensory reactions studied by experimental caloric test
[NASA-TM-76386] N81-20718

VERY LOW FREQUENCIES
Stability of VLF group velocity over long ranges N81-20321

VESTIBULAR NYSTAGMUS
Importance of photoelectronystagmography for clinical study of the vestibular function
[NASA-TM-76404] N81-20713
Objective appraisal of tolerance to ventriculography with various radiocontrast media (according to electronystagmography data)
[NASA-TM-76340] N81-20721

VESTIBULAR TESTS
Characteristics of vestibulosensory reactions studied by experimental caloric test
[NASA-TM-76386] N81-20718
The functional status of the human vestibular analysor following 56 days in an aqueous immersion medium
[NASA-TM-75888] N81-20725

VESTIBULES
Surgical access to separate branches of the cat vestibular nerve
[NASA-TM-76478] N81-20715

VIBRATION
Transient analysis of vibrations in nonideal multilayered piezoelectric devices
[SAND-80-1909] N81-20937

VIBRATION DAMPING
Damping synthesis for ARIANE payload coupled analyses
[CNES-79/CT/PRT/SST/SM/331] N81-20155
A comparison of damping synthesis methods for space vehicle dynamic analysis
[CNES-80/CT/PRT/SST/SM/316] N81-20171

VIBRATION ISOLATORS
Total main rotor isolation system analysis
[NASA-CR-165666] N81-20027

VIBRATION METERS
Dynamic test of an arch dam using a laser light vibration sensor
[CISE-1576] N81-20482

VIBRATION TESTS
GIRL: German Infrared Laboratory. Telescope study, phase B
[NASA-TM-75911] N81-20866

VIBRATIONAL SPECTRA
Studies of free radicals by ultraviolet excimer laser photolysis
[DOE/ER-10396/2] N81-20419

VIDEO DATA
The effect of interference on delta modulation encoded video signals
[NASA-CR-160923] N81-20324
Technical demonstration: A high density image visualization system --- for producing a photographic print from video data N81-20522
Real-time grey-level histogram manipulation N81-20807
Evaluation of a realtime prototype automatic target cuer N81-20823

VIRGINIA
Davison AAF, Ft. Belvoir Virginia, Revised Uniform Summary of Surface Weather Observations (RUSSWO), parts A-F
[AD-A095332] N81-20672

VISCOELASTICITY
An experimental device for measurement of the viscoelastic properties of thickened liquids
[AD-A095396] N81-20225
Viscoelastic propellant effects on Space Shuttle Dynamics
[NASA-TM-82403] N81-20289
The viscoelastic behavior of the human intervertebral disc N81-20705

VISCOUS DAMPING
Natural nutation damping due to the ergols of the hot gaz propulsion system. Synthesis of MV1 and MV2 in-flight results
[CNES-79/CT/PRT/SST/SS/166] N81-20170

VISCOUS FLOW
Aerodynamics of advanced axial-flow turbomachinery
[NASA-CR-163995] N81-20079
The motion of macromolecules and immiscible drops in creeping flow N81-20274
Utilization of an efficient numerical method for viscous flow problem solutions
[AD-A095758] N81-20396
An asymptotic method for determining the transport of heat and matter by creeping flows with strongly variable viscosity; Fluid-dynamic problems motivated by island arc volcanism N81-20633

VISIBILITY
Revised Uniform Summary of Surface Weather Observations (RUSSWO), Maui Optical Site, Mount Halekulia, Hawaii, parts C, E-F
[AD-A095328] N81-20674
Fog characteristics at Otis AFB, Massachusetts
[AD-A095358] N81-20676
The optical contrast of land and sea targets N81-20804

VISIBLE SPECTRUM
Anomalous visible emission observed from the rear side of laser irradiated thin transparent targets
[AD-A095563] N81-20417

VISUAL OBSERVATION
Evaluation of the visual acquisition range of en-route air traffic from cockpit observations
[DFVLR-MITT-80-14] N81-20058

VISUAL PERCEPTION
Simulation technology N81-20095
Visual system Technology: Status and problems --- training simulators N81-20099
Hybrid approaches and industrial applications of pattern recognition
[AD-A095562] N81-20763

VISUAL PHOTOMETRY
The optical contrast of land and sea targets N81-20804

VOICE COMMUNICATION
RACE: An automatic high frequency radio telephone system for communications in remote areas
[CRC-1338-E] N81-20326

VOLATILITY
Detection of metal ions by glass capillary gas chromatographic separation of their volatile chelates N81-20212

VOLCANOES
Physical and chemical characteristics of Mt. St. Helens airborne debris
[LA-UR-81-110] N81-20613

VOLTERRA EQUATIONS
Extension of Volterra analysis to weakly nonlinear electromagnetic field problems with application to whistler propagation --- cold collisionless electron plasma N81-20319
VORTEX SHEDDING
The phenomenon of dynamic stall --- vortex shedding phenomenon on oscillating airfoils
[NASA-TM-81264] N81-20029
VORTEX SHEETS
Leading-edge separation from a slender rolling wing-body combination --- vortex sheet model
[RAE-TR-80039] N81-20040
VORTICES
An extension of the local momentum theory to a distorted wake model of a hovering rotor
[NASA-TM-81258] N81-20030
Experiments using a three-component laser-anemometry system on a subsonic flow with vorticity --- in a wind tunnel
[RAE-TR-80081] N81-20089
Physical arguments and experimental evidence in support of the mesolayer theory of turbulence N81-20377
A feasibility study of an instrument for measuring wind speed employing vortex shedding
[BU-254] N81-20411
Upper tropospheric cyclonic vortices in the tropical South Atlantic
[INPE-1946-RPE/263] N81-20660
An investigation of Tkachenko waves in rotating He2 N81-20916
VOYAGER PROJECT
Radio Jupiter after Voyager: An overview of the Planetary Radio Astronomy observations
[NASA-TM-80718] N81-20988

W

WAKES
Subsonic axisymmetric base flow control using boundary layer thickness and near-wake mass balance variations N81-20024
An extension of the local momentum theory to a distorted wake model of a hovering rotor
[NASA-TM-81258] N81-20030
The velocity induced by the wake of a wind turbine in a shear layer, including ground effect
[FFA-133] N81-20037
About the parametric interplay between ionic Mach number, body-size and satellite potential in determining the ion depletion in the wake of the S3-2 satellite
[AD-A095507] N81-20149
WALL PRESSURE
Two-dimensional adaptive-wall experiments
[AD-A095199] N81-20087
WALLOPS ISLAND
Summary of Jimsphere wind profiles: Programs, data, comments, part 1 --- for use in aeronautical vehicle design and engineering
[NASA-CR-161664] N81-20667
WALLS
Impact of plasma wall interactions on the burn dynamics of Tokamak reactors N81-20883
WARNING SYSTEMS
Airborne lightning warning systems: A survey
[AD-A095354] N81-20045
WASHINGTON
Physical and chemical characteristics of Mt. St. Helens airborne debris
[LA-UR-81-110] N81-20613
HF (High Frequency) radar measurements of circulation in the Eastern Strait of Juan de Fuca near Protection Island (July 1979)
[PB81-127490] N81-20690
WASPALOY
Turbine materials characteristics under low cycle fatigue --- turbine engine disk life
[BMFT-FB-T-79-151] N81-20268
Welding of nickel alloys --- including Inconel and waspaloy
[BMFT-FB-T-79-180] N81-20443
WASTE DISPOSAL
Carbon/graphite composite material study
[NASA-CR-164084] N81-20189
Radioactive waste storage in mined caverns in crystalline rock: Results of field investigations at Stripa, Sweden
[LBL-11651] N81-20857
Radiation effects in crystalline high-level nuclear waste solids
[PNL-SA-8732] N81-20858
WASTE ENERGY UTILIZATION
High-reliability gas turbine combined-cycle development program, phase 1. Volume 2: Appendixes
[EPRI-AP-1599-VOL-2] N81-20434
Development of method and equipment for energy recovery from the exhaust gases of the oil-fueled smelting and holding furnaces
[STU-78-6895] N81-20573
WASTE TREATMENT
Production of ammonia in a packed-bed anaerobic upflow (ANFLOW) bioreactor
[CONF-801104-10] N81-20294
WASTE UTILIZATION
Recovery and use of fission product noble metals
[PNL-SA-8358] N81-20258
Conversion of cellulosic wastes to liquid fuels
[COO-2982-57] N81-20306
Engineering study of pelleting waste paper for energy recovery
[NZERDC-53] N81-20562
WATER CIRCULATION
Satellite altimetric measurements of the ocean. Report of the TOPEX Science Working Group
[NASA-CR-164087] N81-20686
WATER COLOR
Critical evaluation of the radiometric requirements of satellite onboard equipment for the measurement of ocean color
[ESA-CR(P)-1390] N81-20526
WATER CURRENTS
Current-wave spectra coupling project, volume 4. Part A: Formulation of the three-dimensional structure of storm-generated currents. Part B: Summaries of volumes 1, 2 and 3 --- hurricane conditions at potential otec sites
[DOE/SF-20235/T1-VOL-4] N81-20689
WATER FLOW
Green River Basin flow forecasting models
[PB81-124448] N81-20529
WATER HEATING
Water systems modeling --- solar collectors and heating systems N81-20554
WATER MANAGEMENT
Water resource priorities for the midwest --- Ohio, Indiana, Illinois, Michigan, Minnesota, Wisconsin, and Iowa
[PB81-129801] N81-20315
Identification of irrigation practices using photographic and optical-mechanical scanning remote sensing techniques N81-20487
WATER QUALITY
Water resources in North Carolina
[PB81-127318] N81-20533
WATER RESOURCES
Optimal risk-based design of water resource engineering projects
[PB81-136202] N81-20316
Groundwater heat pumps: An examination of hydrogeologic, environmental, legal, and economic factors affecting their use. Volume 2: Appendix D, state hydrogeologic descriptions and maps
[DOE/CS-20060/5120-VOL-2] N81-20398
Water resources in North Carolina
[PB81-127318] N81-20533
Basin development and water allocation
[PB81-127276] N81-20534
Indiana five-year water resources research and development plan. Fiscal years 1982 - 1986 --- hydrologic setting and water resource utilization
[PB81-121253] N81-20621
WATER RUNOFF
Snow water equivalent determination by microwave radiometry
[NASA-TM-82074] N81-20490
WATER TEMPERATURE
Critical evaluation of the radiometric requirements of satellite onboard equipment for the measurement of ocean color
[ESA-CR(P)-1390] N81-20526
WATER TREATMENT
Production of ammonia in a packed-bed anaerobic upflow (ANFLOW) bioreactor
[CONF-801104-10] N81-20294
Water resources in North Carolina
[PB81-127318] N81-20533
WATER VAPOR
A model of the Antarctic sink for stratospheric water vapor N81-20623
Discovery of water vapor maser in the large Magellanic cloud
[INPE-1959-RPE/273] N81-20995
WATERSHEDS
Snow water equivalent determination by microwave radiometry
[NASA-TM-82074] N81-20490
A watershed information system
[PB81-127433] N81-20528
Green River Basin flow forecasting models
[PB81-124448] N81-20529
WAVE EXCITATION
An investigation of Tkachenko waves in rotating He2 N81-20916
WAVE FRONT RECONSTRUCTION
Heterodyne interferometric and moire test methods for surface measurements N81-20914
WAVE FUNCTIONS
Extrinsic specific heat of phosphorus doped silicon
[INPE-1942-RPE/261] N81-20216
Breaking solutions of the variable coefficient Korteweg-deVries equation --- ocean surface
[AD-A095247] N81-20687
Two-centre Coulomb phaseshifts and radial functions
[IPPJ-AM-16] N81-20688
WAVE INTERACTION
A green-function method for wave interaction with a submerged body
[PB81-122269] N81-20403
Nonlinear optical phase conjugation by 3-wave and 4-wave mixing N81-20862
WAVE PROPAGATION
Plane wave derivation N81-20330
Silent boundary methods for transient wave analysis N81-20378
A FORTRAN computer program for calculating the propagation of plane, cylindrical or spherical finite amplitude waves
[AD-A095386] N81-20832
Ultraviolet phase conjugation and its practical implication
[LA-UR-80-3621] N81-20873
WAVEGUIDES
Finite-difference method for the arbitrary cross-section waveguide problem using the best-fit boundary approximation
[INPE-1956-RPE/270] N81-20049
Waveguide model N81-20332
Electromagnetic scattering by open circular waveguides --- modeling jet engine inlets
[AD-A095554] N81-20345
WEAR
Effects of geometric variables on rub characteristics of Ti-6Al-4V
[NASA-TP-1835] N81-20245
WEAR TESTS
Friction and wear studies of graphite and a carbon-carbon composite in air and helium
[GA-A-16054] N81-20191
High speed cylindrical roller bearing development
[AD-A095357] N81-20437
WEATHER
Upper tropospheric cyclonic vortices in the tropical South Atlantic
[INPE-1946-RPE/263] N81-20660
Revised Uniform Summary of Surface Weather Observations (RUSSWO), Maui Optical Site, Mount Haleakula, Hawaii, parts C, E-F
[AD-A095328] N81-20674
WEATHER MODIFICATION
Environmental assessment for the satellite power system concept development and evaluation program. Atmosphere effects
[DOE/ER-0090] N81-20598
WEATHERING
Classification of petroleum samples from gas chromatographic data by pattern recognition techniques and simulation of mass spectra by regression analysis of structural descriptors N81-20202
Adhesion and chemical vapor testing of second surface silver/glass solar mirrors
[PNL-3575] N81-20577

WEDGES
Evaluation of the wedge cleavage test for assessment of durability of adhesive bonded joints --- epoxy resin
[RAE-TM-MAT-349] N81-20479
WEIGHTING FUNCTIONS
A general dynamic synthesis for complex structures composed of substructures N81-20455
WEIGHTLESSNESS
Study on fluid phenomena influencing the design of zero-gravity experiments, volume 1
[TS-1-80-VOL-1] N81-20105
Study on fluid phenomena influencing the design of zero-gravity experiments. Volume 2: Users' guide
[TS-11-79-VOL-2] N81-20106
Islet in weightlessness: Biological experiments on board COSMOS 1129 satellite
[NASA-TM-76396] N81-20692
WELDABILITY
Welding of nickel alloys --- including Inconel and waspaloy
[BMFT-FB-T-79-180] N81-20443
WHISTLERS
Extension of Volterra analysis to weakly nonlinear electromagnetic field problems with application to whistler propagation --- cold collisionless electron plasma N81-20319
WIENER FILTERING
Image restoration parameter choice: A quantitative guide
[AD-A095708] N81-20446
WIND (METEOROLOGY)
Wind energy resource atlas. Volume 4: The Northeast region
[PNL-3195-WERA-4] N81-20592
The President's Day cyclone 17-19 February 1979: An analysis of jet streak interactions prior to cyclogenesis
[NASA-TM-82077] N81-20658
Some large scale aspects of the Southern Ocean and its environment N81-20685
Current-wave spectra coupling project, volume 4. Part A: Formulation of the three-dimensional structure of storm-generated currents. Part B: Summaries of volumes 1, 2 and 3 --- hurricane conditions at potential otec sites
[DOE/SF-20235/T1-VOL-4] N81-20689
WIND MEASUREMENT
Digital filtering of PCM-recorded flight data for wind-processing N81-20009
Wind shear measuring on board an airliner N81-20011
Comparison of wind spectra from spatially averaged and point measurements in complex terrain
[UCRL-84546] N81-20678
WIND PROFILES
Diabatic wind profile and its relation to the scale of turbulence
[INPE-1988-RPE/277] N81-20661
Wind profiles for Space Shuttle loads analysis
[NASA-CR-161676] N81-20666
Summary of Jimsphere wind profiles: Programs, data, comments, part 1 --- for use in aeronautical vehicle design and engineering
[NASA-CR-161664] N81-20667
Comparison of observed and predicted slope winds
[PNL-SA-8785] N81-20679
Boundary-layer structure over the tropical ocean N81-20683
WIND SHEAR
On the use of AIDS-data for a statistical analysis of wind shear during the approach N81-20010
Wind shear measuring on board an airliner N81-20011
A short note on AIDS and windshear: British airways experience --- with a modified vertical speed indicator N81-20012
The velocity induced by the wake of a wind turbine in a shear layer, including ground effect
[FFA-133] N81-20037
An analytical study of the longitudinal response of airplanes to positive wind shear
[NASA-TP-1765] N81-20082
WIND TUNNEL APPARATUS
Comments on settling chamber design for quiet, blowdown wind tunnels
[NASA-TM-81948] N81-20085
Application of superconducting coils to the NASA prototype magnetic balance
[NASA-CR-165660] N81-20086
Experiments using a three-component laser-anemometry system on a subsonic flow with vorticity --- in a wind tunnel
[RAE-TR-80081] N81-20089
WIND TUNNEL MODELS
Experimental investigations on the V/STOL tunnel at NASA/Langley Research Center
[NASA-CR-165655] N81-20028
Support interference of wind tunnel models: A selective annotated bibliography
[NASA-TM-81909] N81-20084
National Transonic Facility: A review of the operational plan
[PB81-115289] N81-20090
WIND TUNNEL TESTS
Aerodynamic characteristics of a hypersonic cruise aircraft concept with wing-mounted propulsion systems at Mach numbers of 2.96, 3.96 and 4.63 --- Langley unitary plan wind tunnel tests
[NASA-TM-81937] N81-20025
The elaboration of a new family of helicopter blade profiles
[NASA-TM-75907] N81-20031
Transonic flow past projectiles with variable nonaxisymmetric cross section
[AD-A095376] N81-20033
Leading edge devices on slender wings --- wind tunnel tests of delta wings
[BU-250] N81-20041
Motorcycle aerodynamics in performance --- wind tunnel and driving tests
[BU-253] N81-20042
Recent progress in V/STOL aircraft technology
[NASA-TM-81281] N81-20066
Support interference of wind tunnel models: A selective annotated bibliography
[NASA-TM-81909] N81-20084
National Transonic Facility: A review of the operational plan
[PB81-115289] N81-20090
Optical measurements of the diffusion of a heavy gas in turbulent boundary layer --- inside a wind tunnel N81-20391
Measurements of the transverse velocity of a separating turbulent boundary layer --- wind tunnel tests
[AD-A095256] N81-20395
WIND TUNNEL WALLS
Two-dimensional adaptive-wall experiments
[AD-A095199] N81-20087
WIND TUNNELS
Operating characteristics of the Langley Mach 7 Scramjet Test Facility
[NASA-TM-81929] N81-20083
WIND VELOCITY
Propagation of traffic noise
[PB81-123523] N81-20619
WINDMILLS (WINDPOWERED MACHINES)
The velocity induced by the wake of a wind turbine in a shear layer, including ground effect
[FFA-133] N81-20037
WINDOWS
Handbook for calculating solar-influenced building heat losses
[SAND-79-2173] N81-20583
WINDOWS (APERTURES)
Fast detonator-activated ball shutter for high explosive experiments
[UCID-18814] N81-20409
WINDPOWERED GENERATORS
Wind generator network methodology and analysis N81-20356
Large wind energy converter: Growian 3 MW
[NASA-TM-75404] N81-20543
WING LOADING
Unsteady airloads on a harmonically pitching wing with external store
[NLR-MP-80004-U] N81-20038
Static test of a wing box structure made of composite materials, phase 1
[FFA-TN-HU-2127] N81-20481
WING NACELLE CONFIGURATIONS
Aerodynamic characteristics of a hypersonic cruise aircraft concept with wing-mounted propulsion systems at Mach numbers of 2.96, 3.96 and 4.63 --- Langley unitary plan wind tunnel tests
[NASA-TM-81937] N81-20025
WING PANELS
Crack propagation in electron beam welded Ti-6Al-4 under spectrum loading conditions
[AD-A095585] N81-20467
WING PROFILES
The elaboration of a new family of helicopter blade profiles
[NASA-TM-75907] N81-20031
An application of the embedded grid technique to the calculation of transonic flow past wings --- Cartesian grids and programming
[FFA-TN-AU-1600] N81-20036
WINGS
Application of a structural optimization procedure for advanced wings
[AGARD-R-691] N81-20064
A study of high-altitude manned research aircraft employing strut-braced wings of high-aspect-ratio
[NASA-CR-159262] N81-20067
The prediction of normal force and rolling moment coefficients for a spinning wing
[NASA-CR-165680] N81-20068
WOOD
Stoichiometry of wood liquefaction
[LBL-11776] N81-20296
Liquefaction of biomass
[LBL-PUB-350] N81-20576
WORK HARDENING
Mechanism of work hardening in Hadfield manganese steel N81-20243
WYOMING
Summary of the western energy overhead monitoring project
[PB81-129009] N81-20531

X

X RAY ASTRONOMY
MM-wave and X-ray observastions of a Cen-A flare
[INPE-1958-RPE/272] N81-21005
X RAYS
Brazilian magnetic anomaly
[INPE-1935-RPE/258] N81-20636
The nature of the spatial structure of diffuse soft X-rays in the direction of the North Polar Spur N81-21004
XENON
Study of the ionization of C, N, O, Nr, Kr and Xe positive ions by electron impact
[ORNL-TR-4702] N81-20841
Structural and thermodynamic properties of xenon, krypton, and argon adsorbed on silver(111) N81-20924

Y

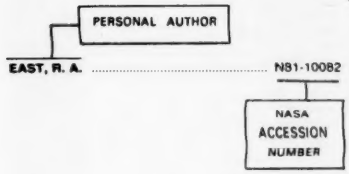
YAW
The influence of roll orientation-dependent aerodynamics on the stability of cruciform missile configurations
[AD-A095269] N81-20151
YIELD POINT
Damage tolerance of hybrid structures --- crack propagation in aluminum alloy sheet reinforced by four unidirectional fiber/epoxy strips
[BMVG-FBWT-79-27] N81-20477
YTTRIUM
Aspects of metal NMR and high sensitivity probe design N81-20201

Z

ZINC
Development of zinc-bromine batteries for utility energy storage
[DOE/ET-29345/21] N81-20591
ZINC ALLOYS
Studies of hydrogen embrittlement and stress-corrosion cracking in an aluminum-zinc-magnesium alloy
[DOE/ER-01198/1325] N81-20256
Die casting
[PB81-123697] N81-20314
ZINC COATINGS
Galvanizing
[PB81-120271] N81-20271

Defects in galvanized products. An inspection guide
[PB81-123671] N81-20452
ZINC COMPOUNDS
A feasibility study on the growth of bulk GaN single crystals
[AD-A095567] N81-20931
ZINCBLENDE
Superstructure phonons and their characterization by Raman Spectroscopy --- zincblende and metal oxides N81-20929

Typical Personal Author Index Listing



Listings in this Index are arranged alphabetically by personal author. The NASA accession number denotes the number by which the citation is identified.

A

AAMODT, R. L. N81-20580
ABBISS, J. B. N81-20089
ABDU, M. A. *N81-20635*
ABDULMUMINI, S. N81-20626
ABDUSATTAROV, A. N81-20727
ABSTON, C. C. *N81-20653*
ACCORNERO, A. N81-20432
ACOSTA, A. J. N81-20382
ADAM, P. *N81-20443*
ADAMSON, C. W. N81-20304
ADELFANG, S. I. N81-20666
AGARWAL, P. *N81-20101*
AGARWALA, V. S. N81-20250
AGENT, K. R. N81-20619
AGERSTRAND, T. N81-20565
AGGARWAL, R. K. *N81-20822*
ALEKSANDROV, V. V. N81-20905
ALEXANDER, J. K. N81-20988
ALISHAHI, M. M. *N81-20086*
ALLEN, J. H. N81-20653
ALLEN, S. L. N81-20878
ALLENDORF, G. N81-20595
ALPERT, D. J. *N81-20622*
AMAZIGO, J. C. N81-20469
AMIEUX, J. C. N81-20153
ANDERECK, B. S. *N81-20915*
ANDERECK, C. D. N81-20916
ANDERSON, A. C. N81-20569
ANDERSON, C. A. *N81-20472*
ANDERSON, H. E. N81-20583
ANDERSON, J. N81-20568
ANDERSON, K. D. N81-20643
ANDERSON, R. E. *N81-20147*
N81-20337
N81-20338
ANDERSON, W. R. *N81-20408*
ANDRUS, W. S. N81-20646
ANNETT, R. J. N81-20603
ANNIS, C. G., JR. *N81-20080*
ANTHONY, D. N81-20057
ANTHONY, F. M. N81-20312
APELIAN, D. N81-20253
ARBIN, F. L. A. *N81-20272*
ARDONCEAU, P. N81-20392
ARNOLD, D. A. N81-20107
ARNOLD, G. *N81-20874*
ARUTYUNYAN, R. S. N81-20720
ASBRIDGE, J. R. N81-20637
ASHBY, N. N81-20998
ASPVALL, B. I. *N81-20744*
ATCHESON, J. R. N81-20046
N81-20047
ATTIA, A. J. N81-20591
AUDENAERDE, K. *N81-20887*
AUGEREAU, J. F. N81-20144
AULD, H. E. N81-20582
AURILIO, G. N81-20642
AVITZUR, B. N81-20400
AVRAMI, L. N81-20291
AWERBUCH, J. N81-20185
AYZIKOV, G. S. *N81-20715*

B

BAECHLE, E. N81-20373
BAGANOFF, D. N81-20641
BAHM, R. J. *N81-20574*
BAILEY, J. T. N81-20201
BAKER, G. A., JR. N81-20848
BAKHTAR, F. *N81-20430*
BALCOMB, J. D. N81-20586
BALDI, R. W. N81-20904
BALL, R. E. *N81-20892*
BALMINO, G. N81-20110
BAME, S. J. N81-20637
N81-20638
BARANOWSKI, B. B. *N81-20785*
BARCHET, W. R. N81-20592
BARDENHEIER, R. N81-20187
BARLIER, F. *N81-20143*
BARLIER, M. F. N81-20139
BARNA, P. S. N81-20028
BARNSTOFF, H. *N81-20997*
BARTH, G. J. N81-20021
BARTHOLOMEW, C. H. N81-20232
BARTLETT, D. N81-20478
BARTZIS, J. G. *N81-20589*
BATISTA, I. S. N81-20635
BAUDOIN, A. N81-20507
N81-20509
N81-20514
BAUER, D. G. N81-20239
BAUGHMAN, R. H. *N81-20218*
BECK, T. R. N81-20278
BECKWITH, I. E. N81-20085
BEGNI, G. N81-20513
BEHANNON, K. W. *N81-20997*
BELEW, W. W. N81-20570
BELL, A. T. N81-20230
BELLET, D. *N81-20109*
BELLMAN, R., JR. N81-20261
BELOUSOVA, O. I. N81-20699
BEMONT, R. A. *N81-20048*
BENDER, P. *N81-20998*
BENEDICT, R. P. N81-20438
BENSIMON, D. N81-20872
BENSON, A. L. *N81-20618*
BERCHTOLD, J. R. N81-20145
BERGER, H. N81-20412
BERGSTRA, J. A. *N81-20781*
BERLEC, F. J. *N81-20674*
BERSOHN, R. N81-20835
BERTRAM, L. A. N81-20257
BESCH, H. J. *N81-20842*
N81-20853
BETZ, W. N81-20267
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C

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CHESNE N81-20374
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COHEN, M. N81-20378
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CONNELLY, M. N81-20961
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CUNNINGHAM, D. N81-20955
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D

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DAWES, J. B. N81-20350
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DESOUZA, J. R. S. N81-20657
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DEY, A. N. N81-20365
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DORAN, D. G. N81-20475
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DOVICHI, N. J. N81-20204
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DRUMMER, D. M. N81-20205
DUBAN N81-20374
DUCHON, P. N81-20119
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DWIGHT, K. N81-20249

E

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EDLER, L. N81-20581
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ERZBERGER, H. N81-20006
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EVANS, A. G. N81-20448
EVANS, A., JR. N81-20753

F

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FUTCH, A. H. *N81-20907*

G

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GAUCKLER, L. J. N81-20282
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GEHRING, J. W. N81-20288
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GENUNG, R. K. N81-20294
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GERLACH, R. W. N81-20222
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GHOSH, K. N81-20379
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GILMOUR, J. M. N81-20887
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GOODRICH, J. N81-20595
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GORIZONTOV, P. D. N81-20699
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GOSLING, J. T. N81-20637
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GRATHWOHL, G. *N81-20478*
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GREEN, J. A. S. N81-20468
GREENHALGH, D. N81-20351
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GUILDFORD, L. H. N81-20807
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GUY, R. W. N81-20083

H

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HAPPE, R. A. N81-20102
HARDEE, H. C. N81-20525
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HORST, T. W. N81-20679
HORTON, H. T. N81-20952
HORVATH, J. A. N81-20904
HOSKEN, G. B. N81-20228
HOUCK, J. A. *N81-20044*
HOUNJET, M. H. L. N81-20039
HOWARD, R. A. N81-20654
HRYCAK, P. *N81-20034*
HSU, P. Y. S. N81-20903
HUBER, W. B. N81-20362
HUETTENHAIN, H. *N81-20302*
HUFFMAN, J. C. N81-20224
HUGHES, G. R. N81-20824
HUGHES, M. C. N81-20252
HUISMAN, W. C. *N81-20809*
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HUNT, M. L. N81-20308
HURD, A. G. *N81-20642*
HURDITCH, R. J. N81-20154
HURST, E. B. N81-20172
HUTH, G. K. N81-20157
N81-20327
HUTH, H. N81-20477
HUTTON, P. H. N81-20834
HWA, R. C. N81-20845
HYDE, I. C. N81-20936
HYER, M. W. N81-20184

I

IDE, Y. N81-20724
IGA, K. N81-20867
IMBERT, J. F. N81-20171
IRONS, J. I. *N81-20493*
IRVINCE, G. W. N81-20328
ISAKSON, P. N81-20805

ISCHEN, H. N81-20810
ISHIKAWA, P., JR. N81-20531
IWASAKI, R. N81-20327

J

JACKSON, R. M. B. N81-20818
JACOBSON, I. D. N81-20960
JADOT, R. N81-20550
JAEKEL, R. F. N81-20078
JAFFE, P. N81-20544
JAKLEVIC, J. M. N81-20614
JAMES, D. R. N81-20366
JARBOE, T. R. N81-20896
JARRETT, O., JR. N81-20492
JEFFERIES, K. S. N81-20173
JEFFREY, T. E. N81-20344
JENSEN, G. A. N81-20258
JENSEN, R. J. N81-20587
JEPSON, A. D. N81-20768
JEZEK, K. C. N81-20631
JOGIA, S. N81-20801
N81-20944
JOHANSSON, B. C. A. N81-20037
JOHNSON, C. R., JR. N81-20760
N81-20761
JOHNSON, D. W. N81-20992
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JOHNSON, K. N81-20961
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JOHNSON, T. W. N81-20345
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JONES, D. L. N81-20186
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JONES, R. N81-20568
JONES, R. M. N81-20652
JONES, T. L. N81-20823
JORDAN, A. J. N81-20665
JOSHI, S. M. N81-20311
JOWITT, S. P. N. F. N81-20042
JUDD, J. L. N81-20903

K

KAHN, D. R. N81-20304
KAILASANATH, K. N81-20213
KAISER, M. L. N81-20988
KALBE, H. N81-20017
KAMEL, I. L. N81-20185
KANG, S. C. N81-20754
KANG, S. W. N81-20401
KANNEL, J. W. N81-20425
KAPRANOV, V. Z. N81-20718
KARAKOZOV, K. G. N81-20713
KARLSON, F. V. N81-20302
KASEMIR, H. W. N81-20045
KASHA, H. N81-20855
KASHIWAGI, T. N81-20223
KASISCHKE, E. S. N81-20688
KATEHAKIS, M. N. N81-20445
KATKOV, V. Y. N81-20726
KATZ, I. N81-20150
KATZ, P. G. N81-20529
KATZER, J. R. N81-20295
KAUFMANN, P. N81-21005
KAVANAGH, P. N81-20079
KAWACHI, K. N81-20030
KAZANAS, D. N81-21006
KELLER, E. N81-20819
KELLER, H. N81-20428
KELLY, M. D. N81-20279
KENNISH, W. J. N81-20567
KERSHAW, R. N81-20249
KESNER, J. N81-20887
KESTNER, W. N81-20814
KHALIL, S. R. N81-20308
KHAN, M. K. N81-20796
KHAZAI, B. N81-20249
KHECHINASHVILI, S. N. N81-20713
KHODOROVA, N. A. N81-20697
KIDD, J. N81-20568
KIISHI, T. H. N81-20079
KIMBALL, K. B. N81-20584
KING, F. D. N81-20758
KING, J. H. N81-20996
KING, S. R. N81-20145
KINNEY, M. N81-20961
KIOKA, W. N81-20403
KIRBY, S. J. N81-20042
KIRCHHOFF, V. W. J. H. N81-20634
KIRCHNER, M. E. N81-20090
KIRKBY, C. J. N81-20154
KIRSNER, D. N81-20510
KITTLER, J. N81-20763
KIUREGHIAN, A. D. N81-20483
KLAMER, D. M. N81-20795
KLOECKER, N. N81-20649
KNITTEL, J. N81-20013
KNUTSSON, L. N81-20192
N81-20481
KO, C. R. C. N81-20242
KOBAYASHI, A. S. N81-20470
KOCIN, P. J. N81-20658
KOEHNE, J. N81-20373
KOEPF, D. N81-20664
KOERBER, F. N81-20543
KOFSKY, I. L. N81-20646
KOHL, A. L. N81-20296
KOHLBACHER, G. N81-20373
KOLBESEN, B. O. N81-20369
KOLLER, G. M. N81-20190
KOLODNER, J. N81-20765
KOMORI, A. N81-20898
KONG, M. N81-20632
KOPET, T. G. N81-20869
KOPSTEIN, R. N81-20870
KOROLKOV, A. M. N81-20263
KORZHENYANTS, V. A. N81-20698
KOSCHEL, W. N81-20014
KOTIN, A. D. N81-20596
KOUSKY, V. E. N81-20659
N81-20660
KOVALSKII, P. G. N81-20905
KOWALSKI, B. R. N81-20222
KRAEMER, R. A. N81-20086
KRAMER, J. J. N81-20264
KRAUSE, P. C. N81-20436
KRAUSPE, P. N81-20011
KRESKOVSKY, J. P. N81-20383
KRIESE, M. N81-20617
KROUSGRILL, C. M., JR. N81-20456
KRUMPHOLZ, O. N81-20874
KUDRYASHOV, B. A. N81-20693
KUESTER, J. L. N81-20306
KUHL, J. N81-20617
KULCINSKI, G. L. N81-20887
KUMAR, M. N81-20214
KURTZ, R. J. N81-20834
KWART, H. N81-20295

L

LAGNEAU, J. N81-20554
LAGO, M. B. N81-20499
LAI, J. S. N81-20248
LAIER, W. N81-20819
LAIKIN, E. N81-20415
LAMB, R. N81-20043
LAMYORDMAKPOL, A. N81-20789
LANDZETTEL, K. N81-20816
LANGELAND, T. N81-20788
LAOU, S. N81-20602
LAPP, H. N81-20825
LARALESTIER, D. C. N81-20887
LARGE, G. D. N81-20958
LARSEN, R. N81-20855
LASCHIMKE, R. N81-20265
LAUNDER, B. E. N81-20386
LAVOIE, G. A. N81-20236
LAWRENCE, D. A. N81-20760
N81-20761
LAWTER, J. R. N81-20618
LAZOPOULOS, C. A. N81-20459
LAZZARINI, A. N81-20840
LEARY, K. N81-20063
LEBRUN, J. N81-20557
LECACHEUX, A. N81-20988
LEE, C. W. N81-20919
LEE, J. L. N81-20598
LEE, R. B., III N81-20608
LEE, R. Q. N81-20178
LEE, S. L. N81-20389
LEE, S. W. N81-20353
LEE, W. T. N81-20304
LEE, Y. D. N81-20740
LEGENDRE, P. N81-20116
N81-20128
N81-20129
N81-20502
LEHMBERG, R. H. N81-20416
LEHNERT, B. N81-20890
LEHOCZKY, S. L. N81-20863
LEIDHEISER, H., JR. N81-20252
LEIFER, R. N81-20613
LEIPUNER, L. B. N81-20855
LEIVE, H. N81-20249
LEMENESTREL, J. N81-20497
LEONE, J. M., JR. N81-20607
LEONE, S. R. N81-20419
LEPPING, R. P. N81-20996
LERNER, T. N81-20739
LETCHCO, A. J. N81-20228
LEUNG, C. M. N81-20380
LEVATIN, J. L. N81-20401
LEVY, A. N81-20261
LEVY, D. N81-20133
LEVY, R. N81-20383
LEWIS, G. W. N81-20703
LEWIS, J. H. N81-20434
LEWIS, J. R. N81-20147
N81-20337
LEWIS, M. H. N81-20947
LEWIS, W. M. N81-20682
LI, C. C. N81-20191
LI, J. C. M. N81-20474
LI, N. C. N81-20227
LI, P. S. Y. N81-20920
LIDOFSKY, S. D. N81-20206
LIEBERMAN, H. N81-20746
LIEPMANN, H. W. N81-20090
LIN, C. F. N81-20060
LIN, C. J. N81-20453
LIND, M. A. N81-20577
N81-20578
LINDBERG, L. N81-20909
LINDER, C. G. N81-20958
LINDQUIST, G. H. N81-20418
LINDSTROEM, O. N81-20597
LINFORD, R. K. N81-20896
LINGENFELTER, R. E. N81-21006
LINTON, R. C. N81-20868
LIS, S. N81-20585
LLOYD, G. J. N81-20471
LOEFFLER, A. N81-20375
LOEWENTHAL, S. H. N81-20423
LOF, N. E. N81-20729
LOMOVSKAYA, E. G. N81-20693
LONGHURST, G. R. N81-20903
LOO, B. W. N81-20614
LOO, C. N81-20325
LOUCHET, J. N81-20806
LOVE, W. J. N81-20470
LOVELL, W. A. N81-20067
LOVEMAN, R. N81-20840
LOW, G. D. N81-20168
LOWITZ, G. E. N81-20766
LU, P. N81-20288
LU, P. M. N81-20736
LU, P. Y. N81-20591
LUDLAM, T. N81-20861
LUETJEN, K. N81-20810
LUFT, U. C. N81-20707
LUKAS, H. H. N81-20871
LUONGO, M. C. N81-20438
LUTH, W. C. N81-20525
LYAPINA, L. A. N81-20693

M

MACHADO, F. F. N81-20696
MACK, E. J. N81-20676
MACK, H. N81-20145
MACKAY, T. L. N81-20255
MACMEEKIN, N. E. N81-20805
MADAUSS, B. J. N81-20948
MADDAH, E. N81-20155
N81-20171
MAH, C. P. N81-20950
MAHIN, S. A. N81-20484
MAKOWIECKI, D. N81-20855
MALAKOOTI, M. V. N81-20760
MALLINGER, W. D. N81-20682
MANDELL, M. J. N81-20150
MANDUCA, A. N81-20985

MANION, J. N81-20961
MANKER, L. F., JR. N81-20260
MANKIN, J. B. N81-20778
MANSFIELD, D. K. N81-20421
MANSON, J. N81-20252
MAQUET, J. N81-20121
MARCE, J. L. N81-20170
N81-20503
MARCONDESDESOUZA, J. P. N81-20696
MARETTO, L. N81-20432
MARIE, T. L. N81-20570
MARKOWSKI, E. P. N81-20791
MARONDE, R. N81-20327
MARSCHALL, P. N81-20874
MARSHALL, J. N81-20896
MARSHALL, M. H. N81-20168
MARTIN, B. G. N81-20863
MARTINEK, H. N81-20344
MARTINKA, M. N81-20251
MARTSCHING, G. A. N81-20262
MASLOWSKI, S. N81-20874
MASON, J. R. N81-20078
MATHE, A. W. N81-20145
MATHEY, E. L. N81-20953
MATHIS, J. J., JR. N81-20608
MATHIS, R. A. N81-20366
MATSNEV, E. I. N81-20725
MATSUMOTO, O. N81-20889
MATTHEI, W. N81-20595
MAYER, J. W. N81-20933
MAYER, K. R. N81-20369
MAYNARD, C. W. N81-20887
MAYNARD, D. P. N81-20495
MAYS, L. W. N81-20316
MAZOUR, T. J. N81-20048
MCCARTNEY, J. T. N81-20576
MCCLANAHAN, E. D. N81-20939
MCCORMICK, B. W. N81-20068
MCCOWN, B. N81-20687
MCCROSKEY, W. J. N81-20029
MCDONALD, H. N81-20383
MCDONALD, R. R. N81-20545
MCDONNELL, M. J. N81-20446
MCELMAN, J. A. N81-20465
MCKENNA, K. F. N81-20896
MCKINNON, J. A. N81-20653
MCLARNON, B. N81-20326
MCLEAN, E. A. N81-20417
MCLEAN, J. D. N81-20006
MCLEOD, M. J. N81-20732
MCMASTER, R. H. N81-20921
MCMORDIE, R. N81-20568
MCQUISTON, F. C. N81-20399
MCWILLIAMS, R. A. N81-20409
MEAGHER, G. M. N81-20175
MELLO, L. A. C. N81-20049
MERCERET, F. J. N81-20682
MERCHANT, D. C. N81-20530
MERLINO, R. L. N81-20884
MERRBAUM, S. N81-20703
MESZAROS, P. N81-21006
METAG, V. N81-20840
MEYER, D. N81-20821
MICALE, F. J. N81-20252
MICHEL, D. J. N81-20246
MICNAS, R. N81-20942
MIDHA, C. K. N81-20790
MIEDANER, P. N81-21003
MIILLE, M. J. N81-20200
MIKHAYLOV, V. M. N81-20726
MILEY, G. H. N81-20902
MILLEN, J. K. N81-20737
MILLER, L. G. N81-20903
MILNE, R. K. N81-20793
MILSTEIN, L. B. N81-20347
MINK, A. N81-20755
MINSTER, J. B. N81-20645
MIOLA, J. A. N81-20057
MISHRA, R. K. N81-20938
MISTRY, H. N81-20043
MOECKEL, R. B. N81-20769
MOFFATTS, D. L. N81-20345
MOIK, J. G. N81-20489
MOLINO, J. A. N81-20833
MONDKAR, D. P. N81-20485
MONTAG, A. N81-20410
MONTAGUE, J. L. N81-20235
MONTELIONE, P. N81-20436
MOORE, W. T. N81-20288
MORAN, P. J. N81-20287
MORANDO, B. N81-20135
MOREL, J. E. N81-20843
MORGAN, C. R. N81-20753
MORGAN, G. N81-20749
MORI, M. N81-20724
MORRIS, J. W., JR. N81-20367
MORRIS, S. J. S. N81-20833
MORRISON, J. P. N81-21004
MORSE, W. N81-20855
MOTT, D. N81-20644
MROZ, E. J. N81-20613
MUDAR, J. N81-20418
MUELLER, B. N81-20013
MUELLER, J. N. N81-20083
MUELLER, M. N81-20821
MUENZ, W. D. N81-20372
MURADOV, I. S. N81-20698
MURPHY, J. P. N81-21000
MURPHY, N. A. D. N81-20193
MURRAY, R. B. N81-20264
MUSOFF, H. N81-20057
MUTHARASAN, R. N81-20253
MUTSCHLER, H. N81-20808

N

NAGEL, R. T. N81-20826
NAIM, S. N81-20487
NAKAMURA, H. N81-20888
NAKANISHI, S. N81-20178
N81-20180
NARAYAN, C. N81-20400
NASON, J. R. N81-20731
NEEDLES, C. R. N81-20046
N81-20047
NELSON, J. L. N81-20256
NESBITT, J. F. N81-20939
NEU, C. E. N81-20467
NEUBAUER, F. M. N81-20997
NEUMANN, S. N81-20617
NEWELL, H. E. N81-20962
NEWMAN, C. B. N81-20842
N81-20853
NEWNAM, B. E. N81-20420
NICHOLAS, M. G. N81-20309
NICHOLSON, H. W. N81-20846
NICOLET, M. A. N81-20933
NIEMEYER, M. N81-20375
NIIRO, T. N81-20190
NILRAT, F. N81-20404
NINET, J. N81-20728
NINZ, N. N81-20808
NOGUEIRA, M. T. C. N81-20661
NOUEL, F. N81-20111
NOVAKOV, T. N81-20612
N81-20616
NOVALOV, T. N81-20229

O

OGDEN, H. C. N81-20584
OHLEMILLER, T. J. N81-20223
OJIMA, T. N81-20938
OLBRICHT, W. L. N81-20274
OLDENBORG, R. C. N81-20233
OLEARY, A. N81-20762
OLIVARI, D. N81-20393
OLSEN, L. C. N81-20593
ONN, D. G. N81-20264
OSMER, S. R. N81-20048
OSTBERG, D. T. N81-20247
OTT, J. H. N81-20328
OVSYANNIKOV, V. P. N81-20841

P

PACE, M. O. N81-20366
PADGETT, M. J. N81-20941
PADULA, S. L. N81-20830
PAI, R. Y. N81-20366
PALMERTON, J. B. N81-20750
PAPAMASTORAKIS, I. N81-20637
PAPANTONI, K. P. N81-20346
PAPE, D. R. N81-20930
PARISH, T. R. N81-20655
PARK, H. L. N81-20929
PARK, I. B. N81-20771
PARK, J. W. N81-20078
PARKER, L. W. N81-20045
PARKER, R. L., JR. N81-20087
PARKS, D. E. N81-20150
PARMIGIANI, F. N81-20482
PASCHMANN, G. N81-20637
N81-20638
PATINO, G., JR. N81-20288
PATRICK, R. P. N81-20729
PATTERSON, P. L. N81-20625
PAU, L. F. N81-20763
PAVLOVA, M. P. N81-20698
PECHACEK, R. E. N81-20415
PEDREYRA, D. N81-20568
PEET, T. N81-20479
PEMSLER, J. P. N81-20226
PEPITONE, T. R. N81-20151
PERGAMENT, M. I. N81-20905
PERKINS, R. B. N81-20901
PERKINSON, H. E. N81-20185
PERRET, A. N81-20136
PERRIGO, L. D. N81-20258
PERRIN, B. N81-20802
PERRIN, D. R. N81-20613
PERRY, J. E., JR. N81-20586
PETERMANN, K. N81-20874
PETERS, E. T. N81-20618
PETERSEN, S. R. N81-20318
PETERSON, J. J. N81-20730
PETERSON, J. N. N81-20356
PFEIFFER, E. N81-20874
PHEY, S. W. N81-20086
PHILBRICK, R. B. N81-20745
PICK, M. A. N81-20259
PICKENS, J. R. N81-20468
PICKERING, K. E. N81-20592
PIEPLU, J. L. N81-20126
PIETIKAINEN, M. N81-20792
PILKUHN, M. H. N81-20422
PILLIE, R. J. N81-20676
PIMENTEL-FLORES, J. R. N81-20357
PITTMAN, J. L. N81-20025
PITTS, F. L. N81-20668
PLATTS, D. A. N81-20896
POESCHEL, R. L. N81-20174
POETZLBERGER, H. W. N81-20372
POLITOPOULOS, A. S. N81-20145
POLYDOROS, A. N81-20327
POPE, B. G. N81-20842
N81-20853
POPOV, E. P. N81-20484
PORCH, W. M. N81-20678
PORDES, S. H. N81-20842
N81-20853
PORTEIRO, J. L. F. N81-20024
POUKEY, J. W. N81-20844
POVARENNYKH, A. S. N81-20217
POWELL, E. S. N81-20198
POWELL, G. H. N81-20485
POYET, J. P. H. N81-20993
PREACHE, M. M. N81-20702
PREECE, D. S. N81-20473
PRICE, J. E. N81-20067
PRICE, R. G., JR. N81-20176
PRONO, D. S. N81-20895
PSCHUNDER, W. N81-20600
PUCHKOV, V. L. N81-20721
PUGH, A. C. N81-20783
PUGH, E. N. N81-20256
PULLEYBLANK, W. N81-20775
PUTT, R. A. N81-20591

R

RABE, J. A. N81-20596
RABII, S. N81-20935
RABIN, D. M. N81-20986
RADKEVICH, L. A. N81-20715
RAE, W. J. N81-20035
RAEUCHLE, W. N81-20281
RAGAN, D. B. N81-20072
RAHE, A. J. N81-20729
RALEIGH, M. N81-20407
N81-20415
RAMATY, R. N81-21006
RAND, J. L. N81-20406
RANEY, J. P. N81-20830
RANGO, A. N81-20490
RASMUSON, D. M. N81-20449
RASMUSSEN, M. L. N81-20220

RATCLIFF, P. A. N81-20783
RAWLIN, V. K. N81-20179
RAYCHAUDHURI, A. K. N81-20922
RAZIN, S. I. N81-20716
REBUFFET, M. N81-20811
REICHEL, L. N81-20782
REIF, J. H. N81-20738
N81-20773
N81-20774
REINER, D. S. N81-20757
REINHARDT, C. L. N81-20570
REINHARDT, F. W. N81-20234
REITAN, R. C. N81-20869
RENZETTI, N. A. N81-20339
REYNOLDS, R. T. N81-21000
RICE, E. J. N81-20831
RICE, J. S. N81-20328
RICE, W. W. N81-20847
RICH, F. N81-20149
RICHARDS, L. G. N81-20960
RICHARDS, R. T. N81-20828
RICHARDSON, B. R. N81-20307
RIEBE, G. D. N81-20025
RIECKER, R. E. N81-20580
RIEKMANN, D. N81-20877
RIEMER, F. N81-20617
RIETHMULLER, M. L. N81-20390
N81-20391
RIHACZEK, A. W. N81-20348
RILEY, C. E. N81-20152
RIPIN, B. H. N81-20416
N81-20891
RISEN, W. M., JR. N81-20218
RITLING, K. N81-20691
ROARK, J. C. N81-20196
ROBERT, J. M. N81-20127
N81-20141
N81-20143
ROBERTS, C. A. N81-20020
ROBERTS, J. B. G. N81-20351
ROBERTS, L. N81-20066
ROBINSON, R. S. N81-20244
ROCK, M. N81-20276
ROELKE, R. J. N81-20076
ROGERS, C. W. N81-20676
ROGERS, J. D. N81-20197
ROHMANN, C. A. N81-20258
ROHN, D. A. N81-20423
ROMAN, J. P. N81-20052
N81-20053
ROMANOWSKI, C. N81-20253
ROOKE, D. P. N81-20480
ROORDA, S. N81-20288
ROOS, R. N81-20038
ROSEN, H. N81-20612
ROSENAU, G. N81-20019
ROSS, J. A. N81-20798
ROSSO, R. N81-20501
ROSTLER, P. S. N81-20893
ROTE, D. M. N81-20598
ROTENBERG, M. N81-20150
ROTH, E. A. N81-20137
ROUCHON, J. N81-20188
ROUFOSSE, M. C. N81-20639
ROZANOVA, V. D. N81-20697
ROZENFELD, P. N81-20049
RUBENCHIK, A. M. N81-20905
RUFF, R. E. N81-20680
RUFOLF, T. N81-20855
RUGGERI, R. T. N81-20278
RUMYANTSEV, G. V. N81-20717
RUNAVOT, J. J. N81-20118
N81-20138
N81-20169
RUSKA, J. N81-20282
RUSSELL, C. T. N81-20637
N81-20638
RUSSER, P. N81-20874
RYAN, L. D. N81-20536
RYCHKO, A. V. N81-20716

S

SABOL, A. P. N81-20083
SAGALYN, R. C. N81-20149
SAHA, S. N81-20722
SAHAI, Y. N81-20663
SAINT, G. N81-20518
SALAZAR, J. E. N81-20653
SALEK, S. M. N81-20220
SALEM, A. M. N81-20799
SALOME, R. N81-20313
SAMIR, U. N81-20149
SANDERS, J. A. N81-20599
SANDRE, A. M. N81-20231
SANGAL, R. N81-20748
SANKEWITSCH, V. N81-20027
SASTRY, S. M. L. N81-20255
SAUERS, I. N81-20366
SAVKIV, T. G. N81-20697
SAWYER, G. A. N81-20859
SCALISE, E., JR. N81-20995
SCANLAN, R. M. N81-20904
SCHAKENBACH, J. T. N81-20592
SCHANK, R. C. N81-20765
N81-20951
SCHEFFEL, J. N81-20910
SCHIEKEL, M. N81-20876
SCHILLING, D. L. N81-20324
SCHINDLER, A. I. N81-20466
SCHLEGELMILCH, R. N81-20866
SCHLUETER, K. N81-20373
SCHMIDT, F. A. N81-20262
SCHMIDT, K. P. N81-20877
SCHMITZ, F. N81-20266
SCHNEIDER, G. N81-20064
N81-20282
SCHNUELLE, G. W. N81-20150
SCHNUERER, K. N81-20478
SCHRA, L. N81-20269
N81-20270
SCHROEDER, M. O. N81-20869
SCHUESSLER, H. N81-20373
SCHUETZ, D. N81-20477
SCHULIG, J. N81-20617
SCHUMAN, M. D. N81-20304
SCHUMANN, G. N81-20617
SCHUURMAN, W. N81-20911
SCHWARTZ, I. B. N81-20770
SCHWEITZER, K. N81-20267
SCKOPKE, N. N81-20637
N81-20638
SCOBIE, N. R. N81-20411
SCOTT, A. J. N81-20903
SCULLY, M. O. N81-20414
SEAMAN, C. H. N81-20546
N81-20548
SEAMSTER, A. G. N81-20840
SEARCY, J. Q. N81-20234
SEARS, W. R. N81-20090
SEDLACEK, W. A. N81-20613
SEGUR, H. N81-20777
SEID-GUSAYNOV, A. A. N81-20726
SENBA, M. N81-20926
SEPANIAK, M. J. N81-20207
SEROVY, G. K. N81-20079
SERREAULT, B. N81-20130
N81-20131
SERREYN, D. V. N81-20869
SERREZE, H. B. N81-20585
SESSO, A. N81-20696
SETHI, S. K. N81-20208
SETTER, N. N81-20923
SHA, W. T. N81-20589
SHAFER, N. J. N81-20786
SHAGAM, R. N. N81-20914
SHAING, K. C. N81-20885
SHALNEV, B. I. N81-20726
SHAPIRO, F. B. N81-20693
SHAPIRO, S. L. N81-20873
SHARPE, P. R. N81-20089
SHEARER, J. A. N81-20057
SHEEHAN, J. E. N81-20191
SHEELEY, N. R., JR. N81-20654
SHELLY, T. L. N81-20286
SHEPARD, G. D. N81-20465
SHEPHERD, O. N81-20642
SHERMAN, S. N81-20410
SHERMAN, W. L. N81-20082
SHERWOOD, A. R. N81-20896
SHILOH, K. N81-20395
SHIMER, D. W. N81-20904
SHIVAPRASAD, B. G. N81-20394
N81-20395
SHIVERN, U. N81-20344
SHOLA, I. N81-20743
SHOWEN, R. L. N81-20349
SHTRIKMAN, S. N81-20872
SHUAIB, A. R. N. N81-20237
SHULZHENKO, Y. B. N81-20725
SICKLES, W. L. N81-20087
SIDORENKO, G. A. N81-20217
SIEFERT, J. W. N81-20008
SIGMAR, D. J. N81-20897
SIMKINS, T. E. N81-20776
SIMMONS, G. W. N81-20252
SIMONICH, D. M. N81-20634
SIMPSON, R. L. N81-20394
N81-20395
SIMS, D. L. N81-20080
SIMS, W. N81-20855
SINGER, R. B. N81-20999
SIVY, G. T. N81-20277
SKARTVEDT, G. N81-20568
SKOBERNE, F. N81-20901
SKRATT, J. N81-20063
SLAGG, N. N81-20288
SLATKINE, M. N81-20872
SLAUGHTER, C. N81-21003
SLEPCHUK, N. A. N81-20717
SLINEY, H. E. N81-20275
SLUDER, R. B. N81-20646
SMITH, A. C., JR. N81-20895
SMITH, A. M. N81-20842
N81-20853
SMITH, D. E. N81-20730
SMITH, D. H. N81-20366
SMITH, H. H. N81-20246
SMITH, J. A. N81-20656
SMITH, J. H. N81-20209
SMITH, J. M. N81-20447
SMITH, P. M. N81-20067
SNELLINGS, I. R. N81-20959
SNOW, R. J. N81-20411
SOLAND, D. E. N81-20822
SOLDATOV, I. N81-20719
SOLNTSEV, B. P. N81-20217
SOLNTSEVA, L. S. N81-20217
SOLOMON, A. A. N81-20280
SONNERUP, B. U. O. N81-20637
N81-20638
SORENSEN, J. A. N81-20051
SOULEILLE, P. N81-20285
SPALVINS, T. N81-20424
SPIES, H. F. N81-20723
SPITSCHAN, H. N81-20617
SPITZ, R. A. N81-20226
SPRANGLE, P. N81-20361
SPRONGL, H. N81-20617
SQUILLANTE, M. N81-20585
SRIVATSANGAM, S. N81-20662
STACEY, W. M., JR. N81-20906
STAHARA, S. S. N81-20033
STALL, R. A. N81-20928
STAMPER, J. A. N81-20416
STANKE, E. C., II N81-20054
STAUFFER, J. D. N81-20953
STECKER, F. W. N81-20994
STEEN, P. G. N81-20150
STEENHOEK, L. E. N81-20210
STEIN, W. E. N81-20420
STEINBECK, J. N81-20876
STEINBERG, M. N81-20301
STEINFELD, J. I. N81-20594
STEINHAUER, L. N81-20908
STELTZ, W. G. N81-20427
STEVENSON, C. D. N81-20290
STEWART, D. N81-20309
STEWART, R. N81-20686
STIES, M. N81-20814
STIKA-BISAHA, K. M. N81-20211
STILES, A. B. N81-20295
STONE, M. H. N81-20479
STRAND, R. H. N81-20305
STRAUBE, M. N81-20617
STRAUSS, F. M. N81-21005
STRIFFLER, W. D. N81-20528
STRUVE, K. W. N81-20886
STUPAKOV, G. P. N81-20698
SUCRE, L. N81-20212
SUEMATSU, Y. N81-20867
SULAIMANA, R. A. N81-20454
SULLIVAN, J. A. N81-20587
SULLIVAN, J. D. N81-20996
SULLIVAN, M. N81-20315
SUMNER, M. B. N81-20194
SWEETMAN, J. A. N81-20199
SWITZER, S. T. N81-20235
SWOLINSKY, M. N81-20009

SZOFRAN, F. R. N81-20863

T

TAKAGI, H. N81-20888
TAKAMORI, M. N81-20724
TAKEDA, N. N81-20183
TALBERT, W. L., JR. N81-20859
TALBOT, M. N81-20585
TANG, Y. N. N81-20854
TANRE, D. N81-20526
TARRIEU, C. N81-20310
TASKA, J. N81-20895
TATRO, R. E. N81-20904
TAYLOR, G. N81-20421
TAYLOR, G. R. N81-20071
TAYLOR, H. W. N81-20685
TAYLOR, K. R. N81-20145
TAYLOR, T. N81-20760
TEIXEIRA, N. R. N81-20663
TENHAVE, J. M. N81-20059
THANGAM, S. N81-20376
THART, W. G. J. N81-20269
THEILE, B. N81-20649
THIBERT, J. J. N81-20031
THIEBAUD, P. M. N81-20340
THOMAS, D. A. N81-20252
THOMAS, D. C. N81-20354
THOMAS, G. N81-20938
THOMAS, G. Z. N81-20172
THOMAS, M. E. N81-20668
THOMMES, J. M. N81-20441
THOMPSON, A. C. N81-20614
THOMSEN, A. G. N81-20528
THORN, D. C. N81-20328
THORTON, M. G. N81-20193
TIEE, J. J. N81-20233
N81-20847
TIEFENBACHER, E. N81-20281
TIGRANYAN, R. A. N81-20701
TILLER, W. A. N81-20931
N81-20932
TINGEY, G. L. N81-20939
TKACHENKO, Z. Y. N81-20695
TOBIASZ, E. J. N81-20437
TOEBES, G. H. N81-20529
TOENSKOETTER, H. N81-20015
TOMITA, A. N81-20862
TONNER, W. B. N81-20325
TORRENCE, M. G. N81-20083
TORRES, L. N81-20169
N81-20444
TRACK, W. N81-20267
TREMAINE, S. G. N81-20833
TREVES, D. N81-20872
TRIVEDI, N. B. N81-20636
TRIVETT, D. H. N81-20832
TSUJIHATA, M. N81-20724
TSVETOV, Y. P. N81-20716
TUCKER, J. V. N81-20781
TUER, T. W. N81-20418
TUNG, Y. K. N81-20316
TURCOTTE, R. N81-20585
TURNER, W. C. N81-20895
TURNQUIST, D. V. N81-20364
TUTTLE, M. H. N81-20084
TUTTLE, R. P. N81-20046
N81-20047
TZINIS, C. H. N81-20218
TZOAR, N. N81-20839

U

UCCELLINI, L. W. N81-20658
UNBEHAUN, R. N81-20876
UNGURIS, J. N81-20924
URZI, R. B. N81-20461
UTHE, E. E. N81-20341
UTKIN, V. N. N81-20726

V

VALDEZ, R. N81-20644
VALERI, V. N81-20696
VANBROCKLIN, S. T. N81-20892
VANBUREN, A. L. N81-20832
VANDENBOSCH, R. N81-20840
VANDENBROEK, C. J. H. N81-20827
VANDERHOOF, J. W. N81-20252
VANDERPLAS, H. A. N81-20572
VANHEESCH, E. J. M. N81-20911
VANKASTEEL, J. N81-20809
VANSANT, J. H. N81-20904
VANSUCH, M. E. N81-20305
VANVLIET, B. M. N81-20215
VASSIE, C. A. N81-20012
VASUDEVAN, R. N81-20829
VENABLES, D. N81-20468
VENEZIAN, G. N81-20689
VERMANDE, M. P. N81-20120
VETROVA, Y. G. N81-20701
VICTOR, G. A. N81-20850
VIENNE, D. N81-20112
N81-20117
N81-20143
VIKHAREV, V. D. N81-20905
VILARDO, J. M. N81-20592
VILLANUCCI, D. P. N81-20646
VIOLLIER, M. N81-20526
VISWANADHAM, Y. N81-20661
VIVIER, J. M. N81-20766
VLACHONIKOLIS, I. G. N81-20784
VOERSMANN, P. N81-20009
VOGT, M. N81-20606
VOLOZHIN, A. I. N81-20698
VOMVORIDIS, J. L. N81-20361
VONBURG, K. N81-20836
VONHOLLE, W. G. N81-20409
VONWACHENFELDT, T. N81-20581
VONZAHN, U. N81-20650
VUILLECOT, C. N81-20498

W

WAGNER, C. N81-20961
WAHL, G. N81-20600
WAISMAN, E. M. N81-20150
WALD, J. W. N81-20858
WALKER, D. M. C. N81-20142
WALSH, C. H. N81-20658
WAMPLER, F. B. N81-20233
N81-20847
WAREING, J. N81-20471
WARREN, J. N81-20056
WARREN, R. C. N81-20457
WARREN, R. W. N81-20420
WARWICK, J. W. N81-20988
WASHBURN, G. F. N81-20067
WATERS, M. H. N81-20051
WATTLE, B. J. N81-20676
WEBB, R. C. N81-20410
WEBER, C. N81-20327
WEBER, O. N81-20019
N81-20058
WEBER, W. J. N81-20858
WEEKS, R. W., JR. N81-20732
WEETER, D. W. N81-20294
WEI, S. Y. N81-20061
WEIMANN, A. N81-20821
WEIMER, W. N81-20819
WEINZIERL, F. N81-20370
WEISS, R. S. N81-20548
WELLS, J. N81-20961
WESSOL, D. E. N81-20903
WEST, J. B. N81-20582
WHARTON, S. W. N81-20493
N81-20494
WHITE, E. R. N81-20016
WHITE, T. N81-20156
WHITE, W. F. N81-20050
WHITLOCK, R. R. N81-20416
WILBUR, P. J. N81-20244
WILDER, D. R. N81-20195
WILDMEN, P. J. N81-20149
WILHITE, A. W. N81-20167
WILLETT, J. A. N81-20667
WILLIAMS, S. M. N81-20046
N81-20047
WILLIAMS, W. J. N81-20070
WILSON, A. R. N81-20150
WILSON, P. D. N81-20309
WINSLOW, A. M. N81-20779
WINSTON, J. G. N81-20420
WIPF, S. L. N81-20860
WIRTH, P. E. N81-20381
WISANDER, D. W. N81-20245
WISER, W. H. N81-20292
WITHERALL, M. W. N81-20410
WITHERSPOON, P. A. N81-20857
WOERNER, K. N81-20371
WOLAK, J. N81-20245
WOLD, A. N81-20249
WOLFF, E. N81-20681
WONG, G. K. N81-20934
WONN, J. W. N81-20436
WOOD, B. L. N81-20570
WOOLLEY, C. T. N81-20311
N81-20741
WRAY, W. O. N81-20936
WRIGHT, H. E., JR. N81-20535
WRIGHT, M. P. N81-20089
WU, I. W. N81-20367
WU, J. C. N81-20396
WUENNENBERG, H. N81-20370
WYLER, J. S. N81-20438

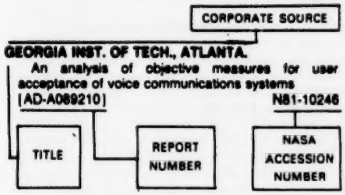
Y

YAGGI, N. F. N81-20227
YANG, J. N. N81-20186
YEE, J. H. N81-20624
YESKE, R. A. N81-20256
YETTER, W. E. N81-20927
YNDESTAD, H. N81-20813
YODER, P. J. N81-20458
YOLTON, C. F. N81-20255
YONEYAMA, T. N81-20938
YONUSHONIS, T. M. N81-20435
YOUNG, D. N81-20156
YOUNG, E. W. N81-20925
YOUNG, J. B. N81-20430
YOUNG, K. K. N81-20842
N81-20853

Z

ZACKS, S. N81-20796
ZAMSTORFF, M. C. N81-20753
ZANNER, F. J. N81-20257
ZARGARYAN, B. M. N81-20713
ZAYAS, V. A. N81-20484
ZEGEER, C. V. N81-20619
ZEHENTMEIER, H. N81-20372
ZEISS, C. N81-20866
ZERDY, G. A. N81-20833
ZHUK, Y. N81-20692
ZORUMSKI, W. E. N81-20830
ZUNINO, E. N81-20432
ZYBIN, O. K. N81-20726
ZYSKO, J. A. N81-20682

Typical Corporate Source Index Listing



Listings in this index are arranged alphabetically by corporate source. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The NASA accession number denotes the number by which the citation is identified. The titles are arranged under each corporate source in ascending accession number order.

A

ACADEMY OF SCIENCES (USSR), MOSCOW.
Structure and properties of light alloys
[TT-76-52003] N81-20263

ACRES SHAWINIGAN LTD., TORONTO (ONTARIO).
Study of the potential for cogeneration in Canada: Industrial steam turbines. Volume 1: Main report
[NP-25187-VOL-1] N81-20563
Study of the potential for cogeneration in Canada: Industrial steam turbines. Volume 2: Economic potential
[NP-25187-VOL-2] N81-20564

ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT, NEUILLY-SUR-SEINE (FRANCE).
Application of a structural optimization procedure for advanced wings
[AGARD-R-691] N81-20064
Fidelity of simulation for pilot training
[AGARD-AR-159] N81-20091
Fidelity of simulation for pilot training. Introduction N81-20092
Pilot training N81-20093
Physiological factors N81-20094
Simulation technology N81-20095
Conclusions and recommendations N81-20096
Assessment of training effectiveness N81-20097
Pilot assessment of Training simulators N81-20098
Visual system Technology: Status and problems N81-20099
Critically loaded hole technology pilot collaborative test programme
[AGARD-R-678] N81-20461
Image and Sensor Data Processing for Target Acquisition and Recognition
[AGARD-CP-290] N81-20803

AEG-TELEFUNKEN, HEILBRONN (WEST GERMANY).
Combination of integrated injection logic (IIL) for UHF analog circuitry
[BMFT-FB-T-80-010] N81-20371
Materials for opto-electronic devices
[BMFT-FB-T-80-026] N81-20940

AEG-TELEFUNKEN, ULM (WEST GERMANY).
Monolithic integrated semiconductor switches with low on-resistance
[BMFT-FB-T-80-016] N81-20373
Development of components for optical communications with light guiding fibers
[BMFT-FB-T-80-006] N81-20874
Flat display panel in liquid crystal technology
[BMFT-FB-T-80-012] N81-20876

AEG-TELEFUNKEN, WEDEL (WEST GERMANY).
Experimental study to define developments for terrestrial solar cell generators
[BMFT-FB-T-79-143] N81-20600

AERITALIA S.P.A., TORINO (ITALY).
Study of heat rejection systems
[TC-80-TR-0054] N81-20165

AEROJET LIQUID ROCKET CO., SACRAMENTO, CALIF.
Dual nozzle aerodynamic and cooling analysis study
[NASA-CR-161677] N81-20175

AERONAUTICAL RESEARCH ASSOCIATES OF PRINCETON, INC., N. J.
Studies in nonlinear motion
[AD-A095559] N81-20777

AERONAUTICAL RESEARCH INST. OF SWEDEN, STOCKHOLM.
An application of the embedded grid technique to the calculation of transonic flow past wings
[FFA-TN-AU-1600] N81-20036
The velocity induced by the wake of a wind turbine in a shear layer, including ground effect
[FFA-133] N81-20037
Flexure tests of three fibrous composite materials
[FFA-TN-HU-2127-PT-3] N81-20192
Static test of a wing box structure made of composite materials, phase 1
[FFA-TN-HU-2127] N81-20481

AEROSPACE CORP., EL SEGUNDO, CALIF.
The aerospace thermal model (HFLUX): Its structure and utility
[AD-A095359] N81-20397

AIR FORCE ENVIRONMENTAL TECHNICAL APPLICATIONS CENTER, SCOTT AFB, ILL.
Revised Uniform Summary of Surface Weather Observations (RUSSWO), Lajes Fld, Terceira, Azores, parts A-F
[AD-A095330] N81-20671
Davison AAF, Ft. Belvoir Virginia, Revised Uniform Summary of Surface Weather Observations (RUSSWO), parts A-F
[AD-A095332] N81-20672
Hickam AFB, Honolulu, Hawaii, revised uniform summary of Surface Weather Observations (RUSSWO), parts A-F
[AD-A095331] N81-20673
Revised Uniform Summary of Surface Weather Observations (RUSSWO), Maui Optical Site, Mount Halekulia, Hawaii, parts C, E-F
[AD-A095328] N81-20674
Portland IAP, Portland, Oregon, Revised Uniform Summary of Surface Weather Observations (RUSSWO), parts A-F
[AD-A095329] N81-20675

AIR FORCE GEOPHYSICS LAB., HANSCOM AFB, MASS.
Error analysis and performance data from an automated azimuth measuring system
[AD-A095446] N81-20057

AIR FORCE PACKAGING EVALUATION AGENCY, WRIGHT-PATTERSON AFB, OHIO.
Test and evaluation of foam-in-place fuel tank container
[AD-A095747] N81-20073

AIR FORCE WRIGHT AERONAUTICAL LABS., WRIGHT-PATTERSON AFB, OHIO.
A system look at real time processing for target acquisition and classification N81-20825

AMERICAN HELIOTHERMAL CORP., DENVER, COLO.
Evaluation of solar collectors for heat pump applications
[DOE/CS-35351/T1] N81-20568

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, NEW YORK.
The 1980 flywheel technology symposium
[CONF-801022] N81-20561

AMES LAB., IOWA.
Preparation of high purity vanadium
[IS-M-305] N81-20262

ANALYSIS AND TECHNOLOGY, INC., NORTH STONINGTON, CONN.
Evaluation of national SAR manual: Probability of detection curves
[AD-A095748] N81-20048

ANALYTICAL MECHANICS ASSOCIATES, INC., MOUNTAIN VIEW, CALIF.
Generation of optimum vertical profiles for an advanced flight management system
[NASA-CR-165674] N81-20051

ANSALDO S.P.A., GENOA (ITALY).
Flow in a 320 MW low-pressure section: Theoretical and experimental evaluation N81-20432

ARGONNE NATIONAL LAB., ILL.
Environmental assessment for the satellite power system concept development and evaluation program. Atmosphere effects
[DOE/ER-0090] N81-20598
Calculation of the thermodynamic properties of fuel-vapor species from spectroscopic data
[ANL-CEN-RSD-80-2] N81-20943

ARGONNE UNIVERSITIES ASSOCIATION, ILL.
Heat loss modeling for the ANL Research Solar Pond
[ANL-CT-80-22] N81-20589

ARIZONA STATE UNIV., TEMPE.
Conversion of cellulosic wastes to liquid fuels
[COO-2982-57] N81-20306

ARIZONA UNIV., TUCSON.
Study of chemical reactions and energy transfer for high-energy and high-power lasers
[AD-A095706] N81-20414
Nonlinear optical phase conjugation by 3-wave and 4-wave mixing N81-20862
The retardation of crystallization of CVD amorphous silicon and the study of its structural and optical properties N81-20912
Heterodyne interferometric and moire test methods for surface measurements N81-20914

ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND, DOVER, N. J.
Explosibility of energetic material dusts
[AD-A095353] N81-20288
Safety and characterization tests on HIVELITE composition 300435
[AD-A095352] N81-20291

ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND, WATERVLIET, N. Y.
The microstructural and property changes of laser treated electrodeposits
[AD-A095345] N81-20254
Finite elements for initial value problems in dynamics
[AD-A095344] N81-20776

ARMY AVIATION RESEARCH AND DEVELOPMENT COMMAND, CLEVELAND, OHIO.
Effects of geometric variables on rub characteristics of Ti-6Al-4V
[NASA-TP-1835] N81-20245
Life analysis of multiroller planetary traction drive
[NASA-TP-1710] N81-20423

ARMY AVIATION RESEARCH AND DEVELOPMENT COMMAND, MOFFETT FIELD, CALIF.
Computation of unsteady turbulent boundary layers with flow reversal and evaluation of two separate turbulence models
[NASA-TM-81259] N81-20384
ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MISS.
Analysis of an assemblage of discs employing interactive graphics
[AD-A095735] N81-20750
ARMY MATERIALS AND MECHANICS RESEARCH CENTER, WATERTOWN, MASS.
Computer techniques for ultrasonic inspection
[AD-A095285] N81-20447
ARMY MATERIEL COMMAND, REDSTONE ARSENAL, ALA.
Microelectronics availability for the Army's missiles
[AD-A095379] N81-20152
Impact of system errors on TMR processing
[AD-A095382] N81-20348
ARMY MOBILITY EQUIPMENT RESEARCH AND DEVELOPMENT CENTER, FORT BELVOIR, VA.
Verification and product-improved tests of the South Coast Technology R-1 electric rabbit
[AD-A095303] N81-20959
ARMY NIGHT VISION LAB., FORT BELVOIR, VA.
Evaluation of a realtime prototype automatic target cuer N81-20823
ARMY TEST AND EVALUATION COMMAND, ABERDEEN PROVING GROUND, MD.
Testing aircraft instruments
[AD-A095680] N81-20075
ARO, INC., ARNOLD AIR FORCE STATION, TENN.
Two-dimensional adaptive-wall experiments
[AD-A095199] N81-20087
AUTOMATION INDUSTRIES, INC., SILVER SPRING, MD.
October 1980 environmental data for sites in the National Solar Data Network
[SOLAR/0010-80/10] N81-20588
AVCO-EVERETT RESEAHCH LAB., MASS.
Investigation of the production of high density uniform plasmas
[AD-A095508] N81-20893
AVCO SYSTEMS DIV., WILMINGTON, MASS.
Modifications to the Flexible Spacecraft Dynamics Program
[NASA-CR-166655] *N81-20166*
AXIOMATIX, LOS ANGELES, CALIF.
Shuttle/payload communications and data systems interface analysis
[NASA-CR-160929] N81-20157
Shuttle/payload communications and data systems interface analysis: Executive summary
[NASA-CR-160929] N81-20158
Shuttle/payload communications and data systems interface analysis: Introduction *N81-20159*
Payload/orbiter signal processing and data handling system evaluation presentation N81-20160
Payloads minimum EIRP formulations *N81-20161*
An update of nonstandard payload modulation restrictions N81-20162
Preliminary interface revision notice SD-152C update of section 8.3 of ICD 2-19001 for detached payloads N81-20163
Shuttle orbiter Ku-band radar/communications system design evaluation
[NASA-CR-160898] N81-20327

B

BALL AEROSPACE SYSTEMS DIV., BOULDER, COLO.
Development of the Coastal Zone Color Scanner for NIMBUS 7. Volume 2: Test and performance data, revision A
[NASA-CR-166649] N81-20491
BALLISTIC RESEARCH LABS., ABERDEEN PROVING GROUND, MD.
Measurement of the line reversal temperature of OH in CH4/N2 O flames
[AD-A095349] *N81-20408*
BARNA (P. STEPHEN), CONSULTANT, NORFOLK, VA.
Experimental investigations on the V/STOL tunnel at NASA/Langley Research Center
[NASA-CR-165655] N81-20028
BATTELLE COLUMBUS LABS., OHIO.
ARI image interpretation research 1970 - 1980
[AD-A095661] N81-20344
Transfer film evaluation for shuttle engine turbopump bearing
[NASA-CR-161672] N81-20425
BATTELLE PACIFIC NORTHWEST LABS., RICHLAND, WASH.
Recovery and use of fission product noble metals
[PNL-SA-8358] N81-20258
Adhesion and chemical vapor testing of second surface silver/glass solar mirrors
[PNL-3575] N81-20577
Alternate protection concepts for second surface silver/glass solar mirrors
[PNL-3629] N81-20578
Comparison of observed and predicted slope winds
[PNL-SA-8785] N81-20679
Acoustic emission. Flaw relationship for in-service monitoring of nuclear pressure vessels
[PNL-SA-8691] N81-20834
Radiation effects in crystalline high-level nuclear waste solids
[PNL-SA-8732] N81-20858
Ion implantation of krypton in sputter-deposited metal matrices
[PNL-SA-8661] N81-20939
BECHTEL NATIONAL, INC., SAN FRANCISCO, CALIF.
Coal preparation using magnetic separation. Volume 5: Evaluation of magnetic coal desulfurization concepts
[EPRI-CS-1517-VOL-5] N81-20302
BEET SUGAR DEVELOPMENT FOUNDATION, FORT COLLINS, COLO.
Technical and economic feasibility of membrane technology
[DOE/CS-40213/T1] N81-20231
BELL-NORTHERN RESEARCH LTD., OTTAWA (ONTARIO).
Exploratory development model hermaphroditic fiber optic connectors
[AD-A095276] N81-20871
BIRMINGHAM UNIV. (ENGLAND).
Nonequilibrium effects in wet-steam turbines N81-20430
BOEING COMMERCIAL AIRPLANE CO., SEATTLE, WASH.
Integrated Application of Active Controls (IAAC) technology to an advanced subsonic transport: Project plan
[NASA-CR-3305] N81-20062
BOEING ENGINEERING AND CONSTRUCTION, SEATTLE, WASH.
Plastic film performance improvement for heliostats
[SAND-79-8185] N81-20579
BOEING VERTOL CO., PHILADELPHIA, PA.
Total main rotor isolation system analysis
[NASA-CR-165666] N81-20027
BONN UNIV. (WEST GERMANY).
A simple static photochemical transport model for application to the upper atmospheres of Earth, Mars and Venus
[BMFT-FB-W-79-35] N81-20650
BOWIE STATE COLL., MD.
Characterization of the physico-chemical properties of polymeric materials for aerospace flight
[NASA-CR-164062] *N81-20276*
BRIGHAM YOUNG UNIV., PROVO, UTAH.
Alloy catalysts with monolith supports for methanation of coal-derived gases
[FE-2729-11] N81-20232
BRISTOL UNIV. (ENGLAND).
Leading edge devices on slender wings
[BU-250] N81-20041
Motorcycle aerodynamics in performance
[BU-253] *N81-20042*
An investigation of drag associated with the upswept rear fuselage of a helicopter
[BU-257] N81-20043
Scarf joints in unidirectional carbon fiber reinforced plastics
[BU-258] N81-20193
A feasibility study of an instrument for measuring wind speed employing vortex shedding
[BU-254] N81-20411
BRITISH AEROSPACE DYNAMICS GROUP, BRISTOL (ENGLAND).
Study of interaction between solar arrays and attitude - orbit control. Volume 1: Technical Report
[ESS/SS-987-VOL-1] N81-20603
The design study of a far infrared heterodyne spectrometer assembly, volume 1
[ESS/CCG-118-VOL-1] N81-20989
The design study of a far infrared heterodyne spectrometer assembly, volume 2
[ESS/CCG-118-VOL-2] N81-20990
BRITISH AEROSPACE DYNAMICS GROUP, HATFIELD (ENGLAND).
Research into methods of image processing for target enhancement and detection N81-20812
BRITISH AIRWAYS, MIDDLESEX (ENGLAND).
A short note on AIDS and windshear: British airways experience N81-20012
Uses of AIDS data in airlines engine maintenance *N81-20016*
BROOKHAVEN NATIONAL LAB., UPTON, N. Y.
Kinetics of hydrogen absorption-desorption by metals
[BNL-28584] N81-20259
Review of fusion synfuels
[BNL-28627] *N81-20300*
Flash pyrolysis and hydropyrolysis of coal
[BNL-28577] N81-20301
FASTBUS system used in a high energy experiment
[BNL-28613] N81-20855
Semiconductor devices as track detectors in high energy colliding beams experiments
[BNL-28850] N81-20861
BROWN, BOVERIE UND CIE, A.G. BADEN (SWITZERLAND).
Blade vibration excitation and sound generation by flow nonuniformities *N81-20429*
BROWN UNIV., PROVIDENCE, R. I.
Raman spectra of highly conducting poly-p-phenylene complexes
[AD-A095660] N81-20218
Simultaneous stress relaxation in tension and creep in torsion of 2618 aluminum at elevated temperature
[AD-A095410] N81-20248
Conductivity as a tool for evaluating the homogeneity of sintered discs of transition metal oxides
[AD-A095298] N81-20249
BUREAU DES LONGITUDES, PARIS (FRANCE).
The solar system N81-20135

C

CALIFORNIA INST. OF TECH., PASADENA.
The motion of macromolecules and immiscible drops in creeping flow *N81-20274*
Silent boundary methods for transient wave analysis N81-20378
Dynamics of cavitating cascades
[NASA-CR-161673] N81-20382
A linearization technique for the dynamic response of nonlinear continuae *N81-20456*
A strain-space plasticity theory and numerical implementation N81-20458
Evidence for fault asperities from systematic time-domain modeling of teleseimic waveforms N81-20630
Body and surface wave modeling of observed seismic events
[AD-A095690] N81-20645
Asymptotic boundary conditions for ordinary differential equations. 1. Numerical Hopf bifurcation. 2 N81-20768
Electronic properties associated with donor impurities in multivalley semiconductors *N81-20917*
The application of nuclear techniques to solid state devices
[AD-A095251] *N81-20933*
Studies of stellar populations: Star clusters in M31, the galaxy and the Magellanic Clouds N81-20986
Elemental composition of solar energetic particles
[NASA-CR-164061] N81-21002
CALIFORNIA STATE DEPT. OF TRANSPORTATION, SACRAMENTO.
Formulation and evaluation of new adhesives for highway use
[PB81-129835] *N81-20286*

CALIFORNIA UNIV., BERKELEY.
Catalytic synthesis of hydrocarbons over group 8 of the reaction mechanism metals: A discussion
[LBL-11339] N81-20230
A green-function method for wave interaction with a submerged body
[PB81-122269] N81-20403
Hydrodynamic pressure and added mass for axisymmetric bodies
[PB81-122343] N81-20404
A response spectrum method for random vibrations
[PB81-122301] N81-20483
Cyclic inelastic buckling of tubular steel braces
[PB81-124885] N81-20484
The 3D solid element (type 4 - elastic or elastic-perfectly-plastic) for the ANSR-11 program
[PB81-123242] N81-20485
CALIFORNIA UNIV., BERKELEY. LAWRENCE BERKELEY LAB.
Chemical and catalytic properties of elemental carbon
[LBL-11678] N81-20229
Catalytic synthesis of hydrocarbons over group 8 of the reaction mechanism metals: A discussion
[LBL-11339] N81-20230
Platelet mechanism of erosion of ductile metals
[LBL-11341-REV] N81-20261
Stoichiometry of wood liquefaction
[LBL-11776] N81-20298
Microstructure and properties of A15 superconductors formed by direct precipitation
[LBL-11605] N81-20367
Non-destructive failure prediction for brittle solids
[LBL-10341-REV] N81-20448
Liquefaction of biomass
[LBL-PUB-350] N81-20576
Graphitic carbon in urban environments and the Arctic
[LBL-11677] N81-20612
Aerosol analysis for the regional air pollution study
[LBL-6497] N81-20614
Soot in the atmosphere
[LBL-11676] N81-20616
Radioactive waste storage in mined caverns in crystalline rock: Results of field investigations at Stripa, Sweden
[LBL-11651] N81-20857
Microstructure and properties of step aged rare Earth alloy magnets
[LBL-11680] N81-20938
CALIFORNIA UNIV., DAVIS.
The photochemical transformations of organic compounds in seawater N81-20200
Detection of metal ions by glass capillary gas chromatographic separation of their volatile chelates N81-20212
Turbulence transport models for numerical computation of complex turbulent flows N81-20386
Determination of regional evapotranspiration using energy balance, planetary boundary layer transfer coefficients and regularly recorded data N81-20626
An experimental study of finite Larmor radius effects in a linear Z-pinch N81-20886
CALIFORNIA UNIV., LIVERMORE.
Comparison of wind spectra from spatially averaged and point measurements in complex terrain
[UCRL-84546] N81-20678
New formulation of backward differenced linear multistep methods for ordinary differential equations
[UCID-18825] N81-20779
Formation of compact toroidal plasmas by magnetized coaxial plasma gun injection into an oblate flux conserver
[UCRL-85122] N81-20895
CALIFORNIA UNIV., LIVERMORE. LAWRENCE LIVERMORE LAB.
Effects of strain on the superconducting properties of niobium-tin conductors
[UCRL-53069] N81-20368
Transient boundary-layer flows in combustion environments
[UCRL-84519] N81-20401
Fast detonator-activated ball shutter for high explosive experiments
[UCID-18814] N81-20409
The 1980 flywheel technology symposium
[CONF-801022] N81-20561
Atmospheric Studies in Complex Terrain (ASCOT) information survey
[UCID-18572] N81-20615
Introduction to Praxis
[UCRL-52957-REV-1] N81-20753
Alternating-direction implicit numerical solution of the time dependent, three-dimensional, Singlt fluid, resistive magnetohydrodynamic equations
[UCRL-53086] N81-20780
Sausage mode stability boundaries: Enumeration and verification
[UCID-18879] N81-20851
Scoring methods for implicit Monte Carlo radiation transport
[UCID-18858] N81-20852
Mirror fusion test facility magnet system
[UCRL-52955] N81-20904
Absorption of laser radiation in a plasma with subcritical density
[UCRL-TRANS-11633] N81-20905
Orbit averaged radial buildup code for tandem mirror geometry
[UCID-18905] N81-20907
CALIFORNIA UNIV., LOS ANGELES.
Ultrapure metals preparation in space
[NASA-CR-161678] N81-20101
Structure of the low latitude boundary layer
[NASA-CR-164056] N81-20638
Performance analysis of distributed database systems N81-20734
CALIFORNIA UNIV., SAN DIEGO, LA JOLLA.
Hydrodynamic pressure and added mass for axisymmetric bodies
[PB81-122343] N81-20404
CALSPAN ADVANCED TECHNOLOGY CENTER, BUFFALO, N.Y.
Theoretical studies of three dimensional transonic flow through a compressor blade row
[AD-A095707] N81-20035
CALSPAN CORP., BUFFALO, N. Y.
Fog characteristics at Otis AFB, Massachusetts
[AD-A095358] N81-20676
CANADIAN ASTRONAUTICS LTD., OTTAWA (ONTARIO).
Study on the compatibility of SURSAT and LASS/COMSS technical mission requirements
[CAL-79/91-1] N81-20104
CARNEGIE-MELLON UNIV., PITTSBURGH, PA.
The traveling salesman (0,2) matchings
[AD-A095716] N81-20775
CASTLE TECHNOLOGY CORP., LEXINGTON, MASS.
Survey of electrochemical production of inorganic compounds
[ANL/OEPM-80-3] N81-20226
CENTRE D'ETUDE SPATIALE DES RAYONNEMENTS, TOULOUSE (FRANCE).
Conference on the use of polymers N81-20285
CENTRE D'ETUDES AERODYNAMIQUES ET THERMIQUES, POITIERS (FRANCE).
Turbulence measurements in supersonic flows N81-20392
CENTRE D'ETUDES ET DE RECHERCHES GEODYNAMIQUES ET ASTRONOMIQUES, GRASSE (FRANCE).
Models of the upper Earth atmosphere. Application to satellite trajectory determination N81-20139
CENTRE NATIONAL D'ETUDES SPATIALES, PARIS (FRANCE).
Space vehicle orbital motion
[ISSN-0244-8041] N81-20108
Launch systems for the 1980's N81-20124
Using the ARIANE launch vehicle N81-20125
CENTRE NATIONAL D'ETUDES SPATIALES, TOULOUSE (FRANCE).
Perturbed elliptical motion N81-20110
Space and time reference systems N81-20111
Orbit perturbation: Causes and representation N81-20112
Orbit perturbations: The effects N81-20113
Extrapolation of orbits N81-20114
Measurement for orbit determination N81-20115
Orbit determination: Statistical methods N81-20116
Orbit calculation programs N81-20117
Generalities and definition of a system N81-20118
Attitude and orbit command N81-20119
Principles and sensors for attitude measurement N81-20120
Actuators N81-20121
Attitude determination N81-20122
Space missions and orbit/attitude systems N81-20126
Positioning a geostationary satellite N81-20127
Geostationary satellite stationkeeping. Orbit perturbation N81-20128
Geostationary satellite stationkeeping: Orbit correction strategies N81-20129
A scanning satellite. Maintaining the orbit. SPOT N81-20130
Choice and acquisition of the SPOT satellite orbit N81-20131
The exchange of information between a satellite and the ground for control operations, and starting up the ground system N81-20132
Ground equipment for moving satellites and geostationary satellites N81-20133
Methods of localization by satellites in the ARGOS system N81-20134
The calculation of interplanetary trajectories N81-20136
Interplanetary missions: Upcoming technological aspects N81-20138
Natural reentry of satellites: SKYLAB N81-20141
The reentry of SKYLAB: Reentry tracking and orbit calculation
[CNES-CT/EMT/MT/MS/208] N81-20143
Damping synthesis for ARIANE payload coupled analyses
[CNES-79/CT/PRT/SST/SM/331] N81-20155
Synthesis of work concerning eddy current pendular nutation dampers. Application of theory to equipment qualification and verification on a spin simulator
[CNES-78/CT/PRT/SST/SS/197] N81-20169
Natural nutation damping due to the ergols of the hot gaz propulsion system. Synthesis of MV1 and MV2 in-flight results
[CNES-79/CT/PRT/SST/SS/166] N81-20170
A comparison of damping synthesis methods for space vehicle dynamic analysis
[CNES-80/CT/PRT/SST/SM/316] N81-20171
Evaluation of a pyrotechnic actuator concept by means of the probit statistical method. Justification of the choice of this method; application; examples of application
[CNES-78/CT/PRT/SST/SE/72] N81-20310
Catalog of French cold gas equipment for use in space applications
[CNES-CT/PRT/SST/SE/349] N81-20313
Magnetic bearing reaction wheel tests
[CNES-80/CT/PRT/SST/SS/162] N81-20444
Spaceborne cartography of the Earth N81-20496
Dynamic spatial geodesy N81-20499
General reflections N81-20500
Geometrical quality of scanning sensor imagery N81-20501
On the orbits used for Earth observation missions N81-20502
Earth observation satellite attitude N81-20503
Spaceborne scanners for photoelectric detection N81-20508
Principle and performance of radar sensors N81-20511
Satellite limitations compared to mission requirements for Earth observation N81-20512
Radiometric degradation of images and ground preprocessing N81-20513
Geometrical correction of images: Methods and performance N81-20517
Processing radiometric data for cartography N81-20518
Overview of the SPOT mission and description of the ground segment N81-20519
The SPOT satellite image processing facility in Toulouse and its capabilities N81-20520
Technical demonstration: An interactive system for image processing N81-20521
Technical demonstration: A high density image visualization system N81-20522
Technical demonstration: Apparatus for locating landmarks N81-20523
CENTRO INFORMAZIONI STUDI ESPERIENZE, MILAN (ITALY).
Dynamic test of an arch dam using a laser light vibration sensor
[CISE-1576] N81-20482
CITY UNIV. OF NEW YORK, N. Y.
The effect of interference on delta modulation encoded video signals
[NASA-CR-160923] N81-20324

Theoretical studies of atom surface interactions
[AD-A095341] N81-20839

COLORADO STATE UNIV., FORT COLLINS.

Passivation of carbon steel through mercury implantation
[NASA-CR-165292] N81-20244

A watershed information system
[PB81-127433] N81-20528

COLORADO UNIV., BOULDER.

Studies of free radicals by ultraviolet excimer laser photolysis
[DOE/ER-10396/2] N81-20419

COLORADO UNIV. AT BOULDER.

Thundercloud local electric field intensification during the pre-breakdown phase of lightning N81-20657

Accuracy of gravitational physics tests using ranges to the inner planets
[NASA-CR-164080] N81-20998

COLT INDUSTRIES, INC., PITTSBURGH, PA.

Metallurgical characterization of superplastic forming
[AD-A095720] N81-20255

COLUMBIA UNIV., NEW YORK.

Laser fluorescence immunoassay N81-20206

On the optimal maintenance of reliability systems N81-20445

Reflection and transmission of obliquely incident Rayleigh waves at a vertical discontinuity N81-20629

Geophysical investigations of the southern continental margin of Australia and the conjugate sector of East Antarctica N81-20632

Some large scale aspects of the Southern Ocean and its environment N81-20685

Improved acoustic approximations for submerged shells N81-20829

Ultraviolet photodissociation of molecular beams
[AD-A095472] N81-20835

Study of direct single photons and correlated particles in proton-proton collisions at square roots = 62-4 GeV (CCOR collaboration)
[DOE/ER-02232/94] N81-20842

Measurement of the transverse momenta of partons and of jet fragmentation as a function of square roots in p-p collisions: CCOR Collaboration
[DOE/ER-02232/92] N81-20853

Time-dependent convection N81-20993

COMMISSION OF THE EUROPEAN COMMUNITIES, LUXEMBOURG.

Improvement of the electrolytic process of hydrogen production
[EUR-6764-FR] N81-20299

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Subjective evaluation of FM/FM protection radio for television broadcasting by satellite, appendices
[CRC-1340] N81-20325

RACE: An automatic high frequency radio telephone system for communications in remote areas
[CRC-1338-E] N81-20326

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[DOE/AF-10001/T2] N81-20293

CONNECTICUT UNIV., STORRS.

Effect of additives on the lean detonation limit of kerosene sprays in air
[AD-A095190] N81-20221

Toughening of epoxy resin by acrylic elastomer N81-20273

Bounds on transmission delays for the CCRA
[AD-A095658] N81-20346

Boundary layer effects on an acoustic field N81-20826

A heat pulse study of superconducting lead/indium alloys N81-20921

CORNELL UNIV., ITHACA, N. Y.

Quantitative ion microscopy by digital image processing N81-20205

Elemental distributions of biological materials by ion microscopy N81-20211

Short transit time photoconductive detectors for high speed optical communication N81-20320

Simulation studies of the stability of weak and strong ion layers and rings N81-20882

A search for the origin of low temperature anomalies in glasses N81-20922

Fluxoid pinning by planar defects in Pb-Bi alloy films N81-20927

Growth, characterization, and applications of gallium arsenide and germanium layers grown by molecular beam epitaxy N81-20928

Virgo cluster galaxies: Neutral hydrogen studies N81-20991

COUNCIL ON ENVIRONMENTAL QUALITY, WASHINGTON, D.C.

Global future: Time to act. Report to the President on global resources, environment and population N81-20957

CYCLOMATIC INDUSTRIES, INC., SAN DIEGO, CALIF.

Highly efficient welding power supply
[DOE/CS-40023/T1] N81-20441

D

DAIMLER-BENZ A. G., STUTTGART (WEST GERMANY).

Ceramic components for gas turbines
[BMFT-FB-T-79-153] N81-20281

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Evidence for magnetic field reconnection at the Earth's magnetopause
[NASA-CR-164066] N81-20637

DEFENCE RESEARCH ESTABLISHMENT SUFFIELD, RALSTON (ALBERTA).

An experimental device for measurement of the viscoelastic properties of thickened liquids
[AD-A095396] N81-20225

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[AD-A095569] N81-20751

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[AD-A095600] N81-20952

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Radiation effects in amorphous metallic alloys
[DOE/ET-10571/3] N81-20264

Development of unique catalysts for hydrogenitrogenation of coal-derived liquids
[DOE/ET-03297/1] N81-20295

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The 31.4 GHz parametric amplifier
[NASA-CR-166643] N81-20360

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[DOE/TIC-3382] N81-20677

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[DOE/FE-0010] N81-20297

The 1980 flywheel technology symposium
[CONF-801022] N81-20561

DESMATICS, INC., STATE COLLEGE, PA.

Computational aspects of incorporating auxiliary information into an impact acceleration injury prediction model
[AD-A095299] N81-20730

DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, BRUNSWICK (WEST GERMANY).

On contributions to the 10th Symposium on Aircraft Integrated Data Systems (AIDS)
[DFVLR-MITT-80-09] N81-20007

Experiences with flight recorders obtained by analyzing aircraft accidents N81-20019

A quick-look system for the processing of flight data recordings N81-20021

Evaluation of the visual acquisition range of en-route air traffic from cockpit observations
[DFVLR-MITT-80-14] N81-20058

A simple hybrid visual simulation for research flight simulators
[DFVLR-MITT-80-13] N81-20088

DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, OBERPFAFFENHOFEN (WEST GERMANY).

Measurements of lidar backscattering from clouds
[DFVLR-MITT-80-12] N81-20681

The optical contrast of land and sea targets N81-20804

DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, WESSELING (WEST GERMANY).

A TV-tracking system based on computer intelligence N81-20816

DORNIER-WERKE G.M.B.H., FRIEDRICHSHAFEN (WEST GERMANY).

Individual jet engine stress load monitoring with the aid of the flight data recording system LEADS 200 N81-20013

DOUGLAS AIRCRAFT CO., INC., LONG BEACH, CALIF.

Metallurgical characterization of superplastic forming
[AD-A095720] N81-20255

DREXEL UNIV., PHILADELPHIA, PA.

Deformation characteristics and failure modes of notched graphite polymide composites at room and elevated temperatures
[NASA-CR-159375] N81-20185

Melt purification via filtration
[AD-A095414] N81-20253

DU PONT DE NEMOURS (E. I.) AND CO., AIKEN, S.C.

Improved emission spectrographic facility
[DPSPU-80-30-7] N81-20228

DUKE UNIV., DURHAM, N. C.

Mathematical models for dispersion of chromatographic solute bands N81-20194

A chromatographic and spectroscopic characterization of chemically bonded stationary phases N81-20195

The application of photoacoustic spectroscopy to electronic spectroscopy of crystalline solids N81-20196

The viscoelastic behavior of the human intervertebral disc N81-20705

Attenuation of zero sound in liquid He(3)-A N81-20930

DUNLAP AND ASSOCIATES, INC., DARIEN, CONN.

Passenger value structure model: Automated Guideway Transit Technology program
[PB81-120875] N81-20960

DUQUESNE LIGHT CO., PITTSBURGH, PA.

Hydrogen bonding in asphaltenes and coal liquids
[DOE/PC-30252/T1] N81-20227

DURACELL INTERNATIONAL, INC., BURLINGTON, MASS.

Analysis of the Lithium Sulfur Dioxide System at ultra-high rate discharges
[AD-A095549] N81-20365

E

ECOLE NATIONALE SUPERIEURE DE L'AERONAUTIQUE, TOULOUSE (FRANCE).

Basic notions in rational mechanics and applications to space mechanics N81-20109

ECON, INC., SAN JOSE, CALIF.

Study of materials performance model for aircraft interiors
[NASA-CR-152378] N81-20063

EDGERTON, GERMESHAUSEN AND GRIER, INC., IDAHO FALLS, IDAHO.

Integrating reliability analysis and design
[ALO-131] N81-20449

Fusion technology development: First wall/blanket system and component testing in existing nuclear facilities
[EGG-FT-5281] N81-20903

EDGERTON, GERMESHAUSEN AND GRIER, INC., SALEM, MASS.

High voltage, low inductance hydrogen thyratron study program
[AD-A095278] N81-20364

ELECTROCHEMICAL TECHNOLOGY CORP., SEATTLE, WASH.

Determination of the effect of composition structure and electrochemical mass transport properties on adhesion and corrosion inhibition of paint films
[AD-A095293] N81-20278

ELEKTRONIK-SYSTEM G.M.B.H., MUNICH (WEST GERMANY).

Target identification of aircraft using IR/TV-sensor-images N81-20821

EMI ELECTRONICS LTD., FELTHAM (ENGLAND).

Target tracking using area correlation N81-20818

ENCOTH CORP., PRINCETON, N.J.
Advanced theoretical methods for improving the performance of thermionic converters
[DOE/ET-15422/5] N81-20560

ENGINS MATRA, VELIZY (FRANCE).
Strapdown inertial optical system (SIOS)
[REPT-0002/DX60] N81-20153
Ranking various classifications of the same data from ground truths and contingency tables
[ESA-CR(P)-1388] N81-20766

ENVIRONMENTAL PROTECTION AGENCY, ANN ARBOR, MICH.
Comparison of gas phase hydrocarbon emissions from light-duty gasoline vehicles and light-duty vehicles equipped with diesel engines
[PB81-122996] N81-20620

ENVIRONMENTAL RESEARCH INST. OF MICHIGAN, ANN ARBOR.
Coastal remote sensing investigations. Volume 2: Beach environment
[AD-A095692] N81-20688

ENVIROPLAN, INC., WEST ORANGE, N.J.
Description, evaluation, and sensitivity analyses of principal US EPA air quality prediction models
[ANL/EES-TM-111] N81-20611

ESPEE, INC., HUNTSVILLE, ALA.
A statistical data analysis and plotting program for cloud microphysics experiments
[NASA-CR-161663] N81-20665

ETABLISSEMENT TECHNIQUE CENTRAL DE L'ARMEMENT, ARCUEIL (FRANCE).
Target detection and classification in infrared imagery N81-20806
Assistance in interpreting satellite multispectral imagery N81-20811
Numerical target tracking N81-20817

EUROCONTROL AGENCY, BRUSSELS (BELGIUM).
Possible online uses of AIDS data in future ATC systems N81-20018

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH, GENEVA (SWITZERLAND).
Study of direct single photons and correlated particles in proton-proton collisions at square roots = 62-4 GeV (CCOR collaboration)
[DOE/ER-02232/94] N81-20842
Measurement of the transverse momenta of partons and of jet fragmentation as a function of square roots in p-p collisions: CCOR Collaboration
[DOE/ER-02232/92] N81-20853

EUROPEAN SPACE AGENCY, PARIS (FRANCE).
Degradation of the surface finish of the SPACELAB pallet after ultraviolet irradiation
[ESA-STM-215] N81-20284
Materials data retrieval at ESTEC
[ESA-STM-206] N81-20954

EUROPEAN SPACE OPERATIONS CENTER, DARMSTADT (WEST GERMANY).
Interplanetary orbit control N81-20137

F

FARRAN RESEARCH ASSOCIATES, FARNANES (IRELAND).
The design study of a far infrared heterodyne spectrometer assembly, volume 1
[ESS/CCG-118-VOL-1] N81-20989
The design study of a far infrared heterodyne spectrometer assembly, volume 2
[ESS/CCG-118-VOL-2] N81-20990

FEDERAL AVIATION ADMINISTRATION, ATLANTIC CITY, N.J.
Flight tests of the microwave landing system multimode digital processor
[AD-A095449] N81-20056

FLORIDA STATE UNIV., TALLAHASSEE.
Aspects of metal NMR and high sensitivity probe design N81-20201
Mixing, convection, and advection in the upper ocean N81-20684

FLORIDA UNIV., GAINESVILLE.
Experimental studies of the delamination mechanisms in impacted fiber-reinforced composite plates N81-20183
Infrared intensities of alcohols and ethers N81-20197
The deformation of grains during cold-rolling N81-20238
Control of database access and integrity in cellular-logic devices N81-20735
Functional series identification of nonlinear systems for adaptive control N81-20758
On a class of multivariate exponential densities N81-20786
A study of the interstellar medium in NGC 185 and other early-type galaxies N81-20992

FLUIDYNE ENGINEERING CORP., MINNEAPOLIS, MINN.
MHD air heater development technology
[DOE/ET-15602/T2] N81-20590

FOM-INSTITUUT VOOR PLASMAFYSICA, JUTPHAAS (NETHERLANDS).
Ideal MHD equilibrium of a weakly toroidal plasma column with elongated cross section. Part 2: Force-free fields
[REPT-80-124-PT-2] N81-20911

FORD, BACON AND DAVIS, INC., NEW YORK.
Energy emergency contingency plan
[PB81-128704] N81-20604

FORD AEROSPACE AND COMMUNICATIONS CORP., NEWPORT BEACH, CALIF.
Autonomous acquisition simulator and associated data
[AD-A095709] N81-20145

FORD MOTOR CO., DEARBORN, MICH.
HC quench layer formation in combustion processes
[DOE/ET-15303/T5] N81-20236

FORSCHUNGSINSTITUT FUER INFORMATIONSVERARBEITUNG, KARLSRUHE (WEST GERMANY).
A flexible image processing system N81-20810
Semi-Automatic and automatic extraction of objects from aerial images N81-20814
Target tracking and target detection in TV- and FLIR-imagery N81-20820

FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E. V., DARMSTADT (WEST GERMANY).
Damage tolerance of hybrid structures
[BMVG-FBWT-79-27] N81-20477

FULMER RESEARCH INST. LTD., STOKE POGES (ENGLAND).
Study on additional propellants for field emission thrusters
[FRI-R664] N81-20309

G

GARRETT CORP., PHOENIX, ARIZ.
Analytical design of an advanced radial turbine
[NASA-CR-165170] N81-20958

GEC POWER ENGINEERING LTD., WHETSTONE (ENGLAND).
Investigation into the behavior of titanium and titanium alloys under cavitational stress
[GEC-TRANS-2071] N81-20265

GEC TURBINE GENERATORS LTD., MANCHESTER (ENGLAND).
Experimental development of bladings for large steam turbines N81-20433

GENERAL ACCOUNTING OFFICE, WASHINGTON, D. C.
The F/A-18 Naval Strike Fighter: Progress has been made but problems and concerns continue
[AD-A095287] N81-20069
A look at NASA's Aircraft Energy Efficiency program
[PSAD-80-50] N81-20077

GENERAL ATOMIC CO., SAN DIEGO, CALIF.
Friction and wear studies of graphite and a carbon-carbon composite in air and helium
[GA-A-16054] N81-20191

GENERAL DYNAMICS/CONVAIR, SAN DIEGO, CALIF.
Graphite composite truss welding and cap section forming subsystems. Volume 1: Executive summary
[NASA-CR-160933] N81-20462
Graphite composite truss welding and cap section forming subsystems. Volume 2: Program results
[NASA-CR-160932] N81-20463

GENERAL ELECTRIC CO., SCHENECTADY, N. Y.
Position surveillance using one active ranging satellite and time-of-arrival of a signal from an independent satellite
[NASA-CR-166647] N81-20147
Satellite-aided mobile communications limited operational test in the trucking industry
[NASA-CR-166658] N81-20337
Satellite-aided mobile radio concepts study: Concept definition of a satellite-aided mobile and personal radio communication system
[NASA-CR-166646] N81-20338
Development of high-temperature turbine subsystem technology to a technology readiness status, phase 2
[FE-1806-96] N81-20440

GENERAL ELECTRIC CO., ST. PETERSBURG, FLA.
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG), volume 1
[NASA-CR-164051] N81-20538
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 2, appendix A: Selected DSG technologies and their general control requirements
[NASA-CR-164052] N81-20539
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 3, appendix B: State of the art, trends, and potential growth of selected DSG technologies
[NASA-CR-164054] N81-20540
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 4, appendix C: Identification from utility visits of present and future approaches to integration of DSG into distribution networks
[NASA-CR-164055] N81-20541
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 5, appendix D: Cost-benefit considerations for providing dispersed storage and generation for electric utilities
[NASA-CR-164053] N81-20542

GENERAL ELECTRIC CO., WHETSTONE (ENGLAND).
SPIDA: A small program for interactive display and analysis
[REL/R(79)28] N81-20476

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The Roscoe Manual. Volume 2-1: Sample case
[AD-A095535] N81-20742

GEOMET, INC., GAITHERSBURG, MD.
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[PNL-3195-WERA-4] N81-20592

GEORGE WASHINGTON UNIV., WASHINGTON, D.C.
Determination of load sequence effects on the degradation and failure of composite materials
[NASA-CR-164065] N81-20186
Continuity of the optimal value function under the Mangasarian-Fromovitz Constraint Qualification
[AD-A095422] N81-20800

GEORGIA INST. OF TECH., ATLANTA.
A theoretical investigation of the pyrolysis of solid fuels including condensation effects N81-20213
Coupled fluid structure interaction problems, the case of an elastic-plastic shell and an acoustic fluid N81-20379
Utilization of an efficient numerical method for viscous flow problem solutions
[AD-A095758] N81-20396
Dynamic stability of structural elements subjected to step loads N81-20459
Resolving the heat-flow anomaly at the Galapagos Spreading Center N81-20625
Fusion studies program
[DOE/ET-52025/3] N81-20906

GOSUDARSTVENNYI KOMITET PO ISPOLZOVANIYU ATOMNOI ENERGII, MOSCOW (USSR).
Absorption of laser radiation in a plasma with subcritical density
[UCRL-TRANS-11633] N81-20905

GOULD, INC., ROLLING MEADOWS, ILL.
Development of zinc-bromine batteries for utility energy storage
[DOE/ET-29345/21] N81-20591

H

HAMILTON STANDARD, WINDSOR LOCKS, CONN.
Lightside atmospheric revitalization system
[NASA-CR-160897] N81-20731

HANFORD ENGINEERING DEVELOPMENT LAB., RICHLAND, WASH.
Development of an irradiation creep correlation for 20% cold-worked AISI 316 in fusion environments: DAFS contribution
[DOE/FF-02170/T58] N81-20475
HARDIN-SIMMONS UNIV., ABILENE, TEX.
Response of selected microorganisms to experimental planetary environments
[NASA-CR-164064] N81-20733
HARVARD COLL. OBSERVATORY, CAMBRIDGE, MASS.
Theoretical studies of highly ionized species
[DOE/ER-02887/2] N81-20850
HARVARD UNIV., CAMBRIDGE, MASS.
On probabilistic and symmetric parallel computations
[AD-A095657] N81-20738
The complexity of provable properties of first order theories
[AD-A095656] N81-20773
Minimum S-T cut of a planar undirected network in O(n log2(n)) time
[AD-A095539] N81-20774
HAWAII UNIV., HONOLULU.
Current-wave spectra coupling project, volume 4. Part A: Formulation of the three-dimensional structure of storm-generated currents. Part B: Summaries of volumes 1, 2 and 3
[DOE/SF-20235/T1-VOL-4] N81-20689
The composition of the Martian dark regions: Observations and analysis
[NASA-CR-164072] N81-20999
HAZARDS RESEARCH CORP., ROCKAWAY, N.J.
Explosibility of energetic material dusts
[AD-A095353] N81-20288
HIGGINS, AULD AND ASSOCIATES, ALBUQUERQUE, N. MEX.
Solar collector foundation designs
[SAND-80-7070] N81-20582
HONEYWELL SYSTEMS AND RESEARCH CENTER, MINNEAPOLIS, MINN.
Autonomous target screeners N81-20822
Prototype automatic target screener
[AD-A095596] N81-20869
HOUSTON UNIV., TEX.
Effects of hydrogen on the elastic constants of vanadium and palladium single crystals N81-20242
HUGHES RESEARCH LABS., MALIBU, CALIF.
Retrofit and verification test of a 30-cm ion thruster
[NASA-CR-165233] N81-20174

I

IIT RESEARCH INST., CHICAGO, ILL.
Photoelastic studies of internal stress distributions of unidirectional composites
[AD-A095595] N81-20190
Design, construction and testing of a dc bioeffects test enclosure for small animals
[DOE/RA-10157/1] N81-20702
ILLINOIS UNIV. AT URBANA-CHAMPAIGN.
Modified factor analysis of selected RAPS (Regional Air Pollution Study) aerosol data
[PB81-120784] N81-20622
ILLINOIS UNIV., URBANA.
Studies of hydrogen embrittlement and stress-corrosion cracking in an aluminum-zinc-magnesium alloy
[DOE/ER-01198/1325] N81-20256
Charged-particle cross section data for fusion plasma applications
[COO-2218-195] N81-20902
INCO, INC., MCLEAN, VA.
Standard software base release 3
[AD-A095693] N81-20749
INDIAN HOT DIP GALVANIZERS ASSOCIATION, NEW DELHI.
Galvanizing
[PB81-120271] N81-20271
INDIAN LEAD ZINC INFORMATION CENTRE, NEW DELHI.
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[PB81-123671] N81-20452
INDIANA UNIV. AT BLOOMINGTON.
Reactions of metal-metal multiple bonds. 8: Forming Mo-Mo quadruple bonds by reductive elimination (alkyl group disproportionation) in the reactions of 1,2-Mo2R2(NMe)4 compounds (M triple bond M) with carbon dioxide and 1,3-Diaryltriazenes
[AD-A095421] N81-20224
INSTITUT GEOGRAPHIQUE NATIONAL, PARIS (FRANCE).
Spaceborne cartography of the Earth N81-20496
The geometry of geodesy N81-20497
Cartography N81-20498
Principles of photogrammetry N81-20504
Apparatus for reconstruction N81-20505
Orthophotography and numerical terrain models N81-20506
Photographic cameras and return beam vidicons N81-20507
The geometry of scanning imagery N81-20509
Positioning SPOT images: Reconstitution from a stereoscopic pair N81-20510
The localization of reference points N81-20514
Models of deformation N81-20515
Analog rectification N81-20516
INSTITUTE OF PAPER CHEMISTRY, APPLETON, WIS.
The effect of oxygen and anthraquinone on the alkaline depolymerization of amylose N81-20272
INSTITUTO DE PESQUISAS ESPACIAIS, SAO JOSE DOS CAMPOS (BRAZIL).
Finite-difference method for the arbitrary cross-section waveguide problem using the best-fit boundary approximation
[INPE-1956-RPE/270] N81-20049
Extrinsic specific heat of phosphorus doped silicon
[INPE-1942-RPE/261] N81-20216
Electric conduction in n-type germanium and cadmium sulfide
[INPE-1950-RPE/266] N81-20358
Average nocturnal and seasonal variations of sodium nightglow at 23 deg S, 46 deg W
[INPE-1957-RPE/271] N81-20634
Longitudinal differences in the spread F characteristics in the American zone and implications on the F-region dynamo
[INPE-1941-RPE/260] N81-20635
Brazilian magnetic anomaly
[INPE-1935-RPE/258] N81-20636
Daily surface pressure variations in Brazil: Their spatial distributions, origins and effects
[INPE-1974-RPE/279] N81-20659
Upper tropospheric cyclonic vortices in the tropical South Atlantic
[INPE-1946-RPE/263] N81-20660
Diabatic wind profile and its relation to the scale of turbulence
[INPE-1966-RPE/277] N81-20661
Stepwise linear regression experiments in 14 and 19 day hemispheric weather prediction
[INPE-1948-RPE/265] N81-20662
Atmospheric ozone measurements in Brazil data bulletin no. 1, 1974 - 1976
[INPE-1985-RPE/282] N81-20663
Self-consistent many body theory for the standard basis operator Green's functions
[INPE-1962-RPE/275] N81-20942
Discovery of water vapor maser in the large Magellanic cloud
[INPE-1959-RPE/273] N81-20995
Solar wind energy and electric field transfer to the Earth's magnetosphere via magnetopause reconnection
[INPE-1940-RPE/259] N81-21001
MM-wave and X-ray observastions of a Cen-A flare
[INPE-1958-RPE/272] N81-21005
INTERMETRICS, INC., CAMBRIDGE, MASS.
ADA test and evaluation
[AD-A095699] N81-20747
INTERNATIONAL BUSINESS SERVICES, INC., WASHINGTON, D.C.
Intercity, bus, rail, and air service for residents of rural areas
[PB81-120826] N81-20961
IOWA STATE UNIV. OF SCIENCE AND TECHNOLOGY, AMES.
Aerodynamics of advanced axial-flow turbomachinery
[NASA-CR-163995] N81-20079
The influence of turbulence on combustion in open pre-mixed flames N81-20198
Laser fluorescence detection for high performance liquid chromatography N81-20207
New techniques in atomic and molecular laser spectroscopy N81-20210
Stability of VLF group velocity over long ranges N81-20321
Determination of the degree of observability in linear control systems N81-20355
Wind generator network methodology and analysis N81-20356
Finite element simulations of stratified flow over simple geometrical obstructions and arbitrarily complex terrain N81-20607
A model of the Antarctic sink for stratospheric water vapor N81-20623
Aspects of symmetric Bayesian sequential decision problems N81-20789
Contributions to survey sampling and design of experiments N81-20790
Theory of flux-flow voltage noise in type-2 superconductors N81-20920
Action angle variables in classical and quantum mechanics N81-20941
ITEK CORP., LEXINGTON, MASS.
Orbiter Camera Payload System
[NASA-CR-160937] N81-20865
ITT ELECTRO-OPTICAL PRODUCTS DIV., ROANOKE, VA.
Ultra low loss optical fiber cable assemblies
[AD-A095551] N81-20870

J

JET PROPULSION LAB., CALIFORNIA INST. OF TECH., PASADENA.
Comet Science Working Group report on the Halley Intercept Mission
[NASA-TM-82386] N81-20100
Autonomous spacecraft maintenance study group
[NASA-CR-164076] N81-20168
The Deep Space Network: An instrument for radio science research
[NASA-CR-164077] N81-20339
Controller for computer control of brushless dc motors
[NASA-CASE-NPO-13970-1] N81-20352
Critical parameters for coarse coal underground slurry haulage systems
[JPL-PUB-81-11] N81-20495
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG), volume 1
[NASA-CR-164051] N81-20538
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 2, appendix A: Selected DSG technologies and their general control requirements
[NASA-CR-164052] N81-20539
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 3, appendix B: State of the art, trends, and potential growth of selected DSG technologies
[NASA-CR-164054] N81-20540
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 4, appendix C: Identification from utility visits of present and future approaches to integration of DSG into distribution networks
[NASA-CR-164055] N81-20541
Monitoring and control requirement definition study for Dispersed Storage and Generation (DSG). Volume 5, appendix D: Cost-benefit considerations for providing dispersed storage and generation for electric utilities
[NASA-CR-164053] N81-20542
LSA field test
[NASA-CR-164083] N81-20544
Proceedings of the 16th Project Integration Meeting
[NASA-CR-164073] N81-20545
The correction for spectral mismatch effects on the calibration of a solar cell when using a solar simulator
[NASA-CR-164074] N81-20546
Cost/performance of solar reflective surfaces for parabolic dish concentrators
[NASA-CR-164088] N81-20547

Results of the 1980 NASA/JPL balloon flight solar cell calibration program
[NASA-CR-164078] N81-20548

Satellite altimetric measurements of the ocean. Report of the TOPEX Science Working Group
[NASA-CR-164087] N81-20686

Multifunctional transducer
[NASA-CASE-NPO-14329-1] N81-20703

JOHNS HOPKINS UNIV., BALTIMORE, MD.
Physical arguments and experimental evidence in support of the mesolayer theory of turbulence N81-20377

An asymptotic method for determining the transport of heat and matter by creeping flows with strongly variable viscosity; Fluid-dynamic problems motivated by island arc volcanism N81-20633

Point process models of rainfall N81-20656

A study of impurity transport with an EUV spatial imaging detector system on the Alcator A Tokamak N81-20878

Oscillating grid turbulence, including the effects of rotation N81-20881

Far-ultraviolet spectral and spatial imaging of Jupiter and Saturn N81-20987

JOHNSON (JAY M.), EXCELSIOR, MINN.
Sunspace Minnesota: Passive solar design for winter resorts
[DOE/R5-10130/2] N81-20566

JOINT CENTER FOR GRADUATE STUDY, RICHLAND, WASH.
Investigation of solar cells based on Cu20
[DOE/ET-23006/4] N81-20593

JOINT RESEARCH CENTRE OF THE EUROPEAN COMMUNITIES, ISPRA (ITALY).
Thermomechanical solar power/electricity generation. Technico-economic problems and prospectives of development and application N81-20556

K

KARLSRUHE UNIV. (WEST GERMANY).
Information content of LDA-signals and operations of LDA-signal processors N81-20387

High speed velocity measurements using laser-Doppler anemometers N81-20388

High temperature properties of different SiC materials: Creep behavior
[BMFT-FB-T-79-157] N81-20478

KATHOLIEKE UNIVERSITEIT TE LEUVEN (BELGIUM).
Performance of air collector house heating systems with rock bed storage N81-20553

KENTRON INTERNATIONAL, INC., HAMPTON, VA.
A study of high-altitude manned research aircraft employing strut-braced wings of high-aspect-ratio
[NASA-CR-159262] N81-20067

KENTUCKY BUREAU OF HIGHWAYS, LEXINGTON.
Propagation of traffic noise
[PB81-123523] N81-20619

KEO CONSULTANTS, NEWTON, MASS.
Ionization and emission processes in the auroral and equatorial ionosphere
[AD-A095296] N81-20647

KITT PEAK NATIONAL OBSERVATORY, TUCSON, ARIZ.
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[PB81-125569] N81-21003

KONSTANZ UNIV. (WEST GERMANY).
Materials and methods for the development of solar energy
[BMFT-FB-T-80-065] N81-20601

KRAFTWERK UNION A.G., MULHEIM (WEST GERMANY).
Long time corrosion testing with and without mechanical stress of high temperature alloys for the blades of high output land-based gas turbines
[BMFT-FB-T-79-106] N81-20266

Design of nonrotating parts N81-20428

L

LABORATOIRES D'ELECTRONIQUE ET DE PHYSIQUE APPLIQUEE, LIMEIL-BREVANNES (FRANCE).
Fabrication of amorphous silicon solar cells, using an industrial process
[LEP-80.638.SME-689-A] N81-20602

LEHIGH UNIV., BETHLEHEM, PA.
Corrosion control through a better understanding of the metallic substrate/organic coating/interface
[AD-A095420] N81-20252

Upper-bound solutions to flow through conical converging dies
[DOE/ER-10367/T3] N81-20400

Application of the line-spring model to a cylindrical shell containing a circumferential or axial part-through crack N81-20464

LERNER TECHNOLOGY, INC., WILLIAMSVILLE, N. Y.
Automated intelligibility measurement system
[AD-A095664] N81-20739

LIEGE UNIV. (BELGIUM).
Building thermal loads calculations N81-20557

LILLE UNIV. (FRANCE).
Critical evaluation of the radiometric requirements of satellite onboard equipment for the measurement of ocean color
[ESA-CR(P)-1390] N81-20526

LITTLE (ARTHUR D.), INC., CAMBRIDGE, MASS.
Metal particulate emissions from stationary sources. Volume 2: Characterization of collection filters
[PB81-121154] N81-20618

LOCKHEED ENGINEERING AND MANAGEMENT SERVICES CO., INC., LAS VEGAS, NEV.
Summary of the western energy overhead monitoring project
[PB81-129009] N81-20531

LOCKHEED-GEORGIA CO., MARIETTA.
Issues of commonality. Volume 2: Issue analysis
[AD-A095418] N81-20046

Issues of commonality. Volume 1: Executive summary
[AD-A095417] N81-20047

LOGISTICS MANAGEMENT INST., WASHINGTON, D. C.
The development of synthetic fuels: Department of Defense logistics implications
[AD-A095713] N81-20290

LOS ALAMOS SCIENTIFIC LAB., N. MEX.
Fundamental understanding of matter: An engineering viewpoint
[LA-UR-80-3585] N81-20181

Ultraviolet laser photochemistry of halogenated methanes
[LA-UR-80-2798] N81-20233

Casting procedure for barium metal cones used in high-altitude experiments
[LA-8517-MS] N81-20260

Numerical calculation of shock-induced initiation of detonations
[LA-UR-80-2854] N81-20303

LASL Free Electron Laser experiment
[LA-UR-80-3187] N81-20420

Category 1 structures: Safety margin at ultimate load
[LA-UR-80-2858] N81-20472

Basic research needed for the development of geothermal energy
[LA-8562-MS] N81-20580

Performance evaluation of the Balcomb solar house
[LA-UR-80-3453] N81-20586

Solar coal gasification
[DOE/TIC-11384] N81-20587

Physical and chemical characteristics of Mt. St. Helens airborne debris
[LA-UR-81-110] N81-20613

Permeation of protective garment material by liquid halogenated ethanes and a polychlorinated biphenyl
[LA-8572-MS] N81-20732

Single photon excimer laser photodissociation of highly vibrationally excited polyatomic molecules
[LA-UR-80-3459] N81-20847

Perturbation theory approach to the ground state energy in an infinite Fermion system
[LA-UR-80-3658] N81-20848

Tests of dynamical supersymmetries via charged particle transfer reactions
[LA-UR-80-3476] N81-20849

Accelerator development for heavy ion fusion
[LA-UR-80-2822] N81-20859

Concepts and limitations of macroparticle accelerators using traveling magnetic waves
[LA-UR-80-3507] N81-20860

Statistical properties of visible and infrared beams retroreflected through a turbulent atmosphere
[LA-UR-80-3674] N81-20872

Ultraviolet phase conjugation and its practical implication
[LA-UR-80-3621] N81-20873

Physical properties of compact toroids generated by a coaxial source
[LA-UR-80-3238] N81-20896

Inertial fusion program
[LA-7755-PR] N81-20901

Study of the effectiveness of selective absorber coatings and phase change materials in passive solar space heating
[LA-UR-80-2930] N81-20936

LOUGHBOROUGH UNIV. OF TECHNOLOGY (ENGLAND).
Infinite frequency interpretations of minimal bases
[MATH-RES-148] N81-20783

An asymptotic expansion for the distribution of the location linear discriminant function
[MATH-RES-149] N81-20784

A spin coefficient approach to Weyssenhoff fluids in Einstein-Cartan theory
[MATH-RES-153] N81-20801

A Newman-Penrose type formalism for space-times with torsion. Part 2: Exact plane wave solutions
[MATH-RES-143-PT-2] N81-20944

Ghost neutrinos in Einstein-Cartan theory
[MATH-RES-146] N81-20945

A Newman-Penrose type formalism for space-times with torsion. Part 3: Neutrino fields in Einstein-Cartan theory
[MATH-RES-147-PT-3] N81-20946

LOUISIANA STATE UNIV., SHREVEPORT.
Development of a new noninvasive method to determine the integrity of bone in vivo
[NASA-CR-160922] N81-20722

LOUISIANA STATE UNIV. AND A&M COLL., BATON ROUGE.
Atomic collision theory
[AD-A095284] N81-20838

LOVELACE FOUNDATION FOR MEDICAL EDUCATION AND RESEARCH, ALBUQUERQUE, N. MEX.
Specialized physiological studies in support of manned space flight
[NASA-CR-160936] N81-20707

Tolerance of Lower Body Negative Pressure (LBNP) in endurance runners, weightlifters, swimmers and nonathletes N81-20708

Noninvasive aortic bloodflow by Pulsed Doppler Echocardiography (PDE) compared to cardiac output by the direct Fick procedure N81-20709

Beat by beat stroke volume assessment by PDE in upright and supine exercise N81-20710

Instantaneous stroke volume by PDE during and after constant LBNP (-50 torr) N81-20711

Changes in cardiac output and tibial artery flow during and after progressive LBNP N81-20712

LOWELL UNIV., MASS.
Structural response and input identification
[NASA-CR-164079] N81-20465

LUND UNIV. (SWEDEN).
Marine biomass: Algae as source of energy
[NE/BIO-80/12] N81-20581

M

MARTIN MARIETTA AEROSPACE, DENVER, COLO.
Total system design methodology
[AD-A095727] N81-20054

The 10-kilowatt photovoltaic concentrator array fabrication
[SAND-80-7062] N81-20599

MARTIN MARIETTA LABS., BALTIMORE, MD.
The delayed fracture of aluminum alloys
[AD-A095732] N81-20468

MARYLAND UNIV., COLLEGE PARK.
Image restoration parameter choice: A quantitative guide
[AD-A095708] N81-20446

An analytic study of a shared device among independent computing systems N81-20755

A proof of the existence of unstable periodic orbits using computer-based techniques N81-20770
On the use of hierarchically computed 'Mexican Hat' features for texture discrimination [AD-A095718] N81-20792
Electron heating in a high voltage toroidal theta pinch N81-20884
The chemical abundances and physical parameters of RR Lyrae stars N81-20985

MASON AND HANGER-SILAS MASON CO., INC., AMARILLO, TEX.
Selected physical and thermal properties of various formulations of silicone potting compounds [MHSMP-80-63] N81-20235
Analysis of RDX and HMX in PBX 9404 by high performance liquid chromatography [MHSMP-80-55] N81-20307

MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
Further studies on magnus phenomena on spinning and coning bodies [AD-A095193] N81-20032
Initial design and experimental implementation of the traffic advisory service of ATARS [AD-A095462] N81-20055
Application of superconducting coils to the NASA prototype magnetic balance [NASA-CR-165660] N81-20086
Nonequilibrium photochemical reactions induced by lasers [DOE/ET-33056/15] N81-20594
A session with Tinker: Interleaving program testing with program design [AD-A095521] N81-20746
Distributed routing [AD-A095385] N81-20762
Massachusetts Institute of Technology, Plasma fusion center, technical research programs [DOE/ET-52002/T1] N81-20900

MATHEMATICAL SCIENCES NORTHWEST, INC., BELLEVUE, WASH.
Axial shock wave heating of reversed-field theta-pinch plasmas [MSNW-81-1158-1] N81-20908

MAX-PLANCK-INSTITUT FUER METALLFORSCHUNG, STUTTGART (WEST GERMANY).
Investigations on processing and properties of high-temperature silicon carbide materials [BMFT-FB-T-79-170] N81-20282
Investigation of fabrication, composition and properties of new high temperature ceramics based on silicon nitride [BMFT-FB-T-79-174] N81-20283

MCDONNELL-DOUGLAS ASTRONAUTICS CO., HUNTINGTON BEACH, CALIF.
Space platform advanced technology study [NASA-CR-160934] N81-20146

MCDONNELL-DOUGLAS TECHNICAL SERVICES CO., INC., HOUSTON, TEX.
Advanced methods for preparation and characterization of infrared detector materials [NASA-CR-161598] N81-20863

MESSERSCHMITT-BOELKOW-BLOHM G.M.B.H., HAMBURG (WEST GERMANY).
The A310 Aircraft Integrated Data System (AIDS) N81-20017

MESSERSCHMITT-BOELKOW-BLOHM G.M.B.H., MUNICH (WEST GERMANY).
A real-time video tracking system based on Bayes rule N81-20819

MESSERSCHMIDT-BOELKOW G.M.B.H., MUNICH (WEST GERMANY).
Management advantages of the standard work breakdown structure proposed by the European Space Agency for space satellite projects N81-20948

MICHIGAN STATE UNIV., EAST LANSING.
A theoretical assessment of vibrational to rotational energy exchange in the hydrogen fluoride chemical laser N81-20413
An experimental study of large compressive loads upon residual strain fields and the interaction between surface strain fields created by coldworking fastener holes N81-20454
Buckling of a rectangular plate on an elastic foundation, compressed in two directions N81-20457
Considerations in the design of solar engines N81-20536
The electrical resistivity and the thermoelectric ratio of potassium and dilute potassium rubidium alloys below 1 K N81-20919

MICHIGAN UNIV., ANN ARBOR.
Optimum maneuvers of supersonic aircraft, volumes 1 and 2 N81-20060
About the parametric interplay between ionic Mach number, body-size and satellite potential in determining the ion depletion in the wake of the S3-2 satellite [AD-A095507] N81-20149
Gas chromatography of polybrominated biphenyls utilizing electron capture detection N81-20199
Comparative adsorption performance of synthetic absorbents and activated carbons N81-20215
Concentration dependent thermal release of helium-3 implanted in molybdenum N81-20241
Mechanism of work hardening in Hadfield manganese steel N81-20243
Controlled avalanche transit-time triode amplifiers N81-20353
Numerical procedure for predicting the torsional dynamic response of solid media N81-20460
The a priori decision in solar energy and conservation economics N81-20558
A life-cycle model for solar heating system design and economic evaluation Michigan Economic Model for Solar Heating (MESH) N81-20559
A theoretical and experimental study on the atomic oxygen corona in the Earth's atmosphere N81-20624
Function space variable metric methods with applications to singular optimal control computation N81-20759
Ultrasonic imaging with narrow beam insonification across a fluid-metal interface N81-20827

MICROWAVE ASSOCIATES, INC., BURLINGTON, MASS.
High concentration silicon photovoltaic cell development [SAND-80-7068] N81-20595

MIDWEST RESEARCH INST., GOLDEN, COLO.
Photovoltaics information user study [SERI/TR-751-652] N81-20570

MINNESOTA UNIV., MINNEAPOLIS.
A trophic classification of Minnesota lakes based on lake sediments [PB81-124141] N81-20535

MISSISSIPPI STATE UNIV., MISSISSIPPI STATE.
Investigation of Flight Test Methods for measuring the performance of general aviation aircraft [NASA-CR-164057] N81-20065

MISSISSIPPI STATE UNIV., STATE COLLEGE.
Numerical solution of three-dimensional Navier-Stokes equations on an arbitrarily shaped body using a locally one-dimensional scheme N81-20023

MITRE CORP., BEDFORD, MASS.
Logical channel theory [AD-A095663] N81-20737

MONS UNIV. (BELGIUM).
Latent and chemical storage N81-20550
Water systems modeling N81-20554

MOTOREN- UND TURBINEN-UNION MUENCHEN G.M.B.H. (WEST GERMANY).
Examination of the strength of high temperature alloys for gas turbines in hot gas environments [BMFT-FB-T-79-150] N81-20267
Turbine materials characteristics under low cycle fatigue [BMFT-FB-T-79-151] N81-20268
Welding of nickel alloys [BMFT-FB-T-79-180] N81-20443

MOUND LAB., MIAMISBURG, OHIO.
Cermet-bonded metal pins for weldable electrical feedthroughs in alumina [MLM-2796(OP)] N81-20279

MOUNT HOLYOKE COLL., SOUTH HADLEY, MASS.
Weak decays and charm searches [COO-4831-3] N81-20846

N

NAGOYA UNIV. (JAPAN).
Two-centre Coulomb phaseshifts and radial functions [IPPJ-AM-16] N81-20888

NATIONAL ACADEMY OF SCIENCES - NATIONAL RESEARCH COUNCIL, WASHINGTON, D. C.
National Transonic Facility: A review of the operational plan [PB81-115289] N81-20090

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, WASHINGTON, D. C.
Aeronautical Engineering: A continuing bibliography, supplement 132 [NASA-SP-7037(132)] N81-20005
The elaboration of a new family of helicopter blade profiles [NASA-TM-75907] N81-20031
SARSAT: A rescue system for ships and airplanes [NASA-TM-76391] N81-20103
With the solaris project CNES proposes to the Europeans the construction of an entirely automatic space laboratory [NASA-TM-76492] N81-20144
Columbia's first flight shakes down space transportation system [NASA-NEWS-RELEASE-81-39] N81-20156
Space Shuttle Program. Mission operation report. Orbital Flight Test reference document [NASA-TM-82321] N81-20164
Acoustic emission monitoring of polymer composite materials [NASA-TM-76523] N81-20187
Evaluation of the behavior of structures made of high modulus composite materials when struck by lightning [NASA-TM-75866] N81-20188
Infrared spectra of some sulfides and their analogs of binary composition in the long-wave region [NASA-TM-75901] N81-20217
Earth Resources: A continuing bibliography, issue 28 [NASA-SP-7041(28)] N81-20486
Digital processing of remotely sensed images [NASA-SP-431] N81-20489
LAPR: An experimental aircraft pushbroom scanner [NASA-TM-80729] N81-20493
Large wind energy converter: Growian 3 MW [NASA-TM-75404] N81-20543
Annoyance from light aircraft investigation conducted around four airports near Paris [NASA-TM-76532] N81-20609
The effect of immobilization and 3 (beta-aminoethyl)-1, 2, 4 triazol on the calcium content in gastric tissues of guinea pigs during the formation of experimental ulcers [NASA-TM-75992] N81-20691
Islet in weightlessness: Biological experiments on board COSMOS 1129 satellite [NASA-TM-76396] N81-20692
The role of ACTH and glucocorticoids in nonenzymatic fibrinolysis during immobilization stress in animals [NASA-TM-76175] N81-20693
Changes in mast cells and in permeability of mesenteric microvessels under the effect of immobilization and electrostimulation [NASA-TM-75988] N81-20694
Morphological changes in neurons of the hind limb reflex arc during long term immobilization [NASA-TM-75939] N81-20695
Experimental joint immobilization in guinea pigs. Effects on the knee joint [NASA-TM-76067] N81-20696
Change in energy expenditure and brain and adrenal content of catecholamines in rats during muscular loading and hypokinesia [NASA-TM-76148] N81-20697
Effect of six-month hypokinesia in dogs on mineral component, reconstruction and mechanical properties of bone tissue [NASA-TM-76168] N81-20698
Comparison of early reactions of the blood system in rats to immobilization, the action of hypoxia and the administration of erythopoietin [NASA-TM-76169] N81-20699
Preliminary results of scientific research on biosatellite Kosmos-1129 [NASA-TM-76287] N81-20700
Activity of certain enzymes in subcellular fractions of rat liver after flight on Cosmos 1129 biosatellite [NASA-TM-76472] N81-20701

Aerospace Medicine and Biology: A continuing bibliography, supplement 216
[NASA-SP-7011(216)] N81-20704
Importance of photoelectronystagmography for clinical study of the vestibular function
[NASA-TM-76404] N81-20713
Program for the medical examination (consultation) of cosmonauts
[NASA-TM-76471] N81-20714
Surgical access to separate branches of the cat vestibular nerve
[NASA-TM-76478] N81-20715
Functional-morphological parallels of the hypothalamo-pituitary-adrenal system response reaction to long-term hypokinesia
[NASA-TM-76001] N81-20716
Role of a decrease in body heat content in the thermoregulatory reaction of the concha auriculae vessels
[NASA-TM-76370] N81-20717
Characteristics of vestibulosensory reactions studied by experimental caloric test
[NASA-TM-76386] N81-20718
Meniere's disease: A surgeon's tactics
[NASA-TM-76398] N81-20719
Effect of inaction on function of fast and slow muscle spindles
[NASA-TM-76374] N81-20720
Objective appraisal of tolerance to ventriculography with various radiocontrast media (according to electronystagmography data)
[NASA-TM-76340] N81-20721
Pathogenesis of sudden death following water immersion (immersion syndrome)
[NASA-TM-76542] N81-20723
Study on contraction and relaxation of experimentally denervated and immobilized muscles: Comparison with dystrophic muscles
[NASA-TM-76053] N81-20724
The functional status of the human vestibular analysor following 56 days in an aqueous immersion medium
[NASA-TM-75888] N81-20725
Activity of the right cardiac ventricle and metabolism in healthy persons during an orthostatic test after short term immobilization
[NASA-TM-76519] N81-20726
The enzyme spectrum of the small intestine with hypodynamia under conditions of high temperature
[NASA-TM-76150] N81-20727
Orthostatic hypotension
[NASA-TM-75889] N81-20728
Some aspects of the comparison between optics and nonlinear acoustics
[NASA-TM-75859] N81-20802
GIRL: German Infrared Laboratory. Telescope study, phase B
[NASA-TM-75911] N81-20866
Semiconductor devices for optical communications in 1 micron band of wavelength
[NASA-TM-75869] N81-20867
Plasma chemistry for inorganic materials
[NASA-TM-75844] N81-20889
Limitless Horizons. Careers in Aerospace
[NASA-EP-171] N81-20947
The 1981 Budget of the German Federal Ministry for Research and Technology
[NASA-TM-76493] N81-20956
Beyond the atmosphere: Early years of space science
[NASA-SP-4211] N81-20962
The meaning of space science N81-20963
The context N81-20964
Prophets and pioneers of spaceflight N81-20965
The rocket and satellites research panel: The first space scientists N81-20966
The Academy of Sciences stakes a claim N81-20967
Early harvest: The upper atmosphere and cosmic rays N81-20968
Response to Sputnik: The creation of NASA N81-20969
NASA gets under way N81-20970
External relations N81-20971
Rockets and spacecraft: Sine qua non of space science N81-20972
Deepening perspective: A new look at the old world N81-20973
Who decides? N81-20974
The universities: Allies and rivals to NASA N81-20975
Programs, projects, and headaches N81-20976
Jet Propulsion Laboratory: Outsider or insider? N81-20977
Life sciences: No place in the Sun N81-20978
Leadership and changing times N81-20979
International ties N81-20980
Space Science and practical applications N81-20981
Continuing harvest: The broadening field of space science N81-20982
Objectives, plans, and budgets N81-20983
Review and assessment N81-20984

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. AMES RESEARCH CENTER, MOFFETT FIELD, CALIF.

Design of a fuel-efficient guidance system for a STOL aircraft
[NASA-TM-81256] N81-20006
The phenomenon of dynamic stall
[NASA-TM-81264] N81-20029
An extension of the local momentum theory to a distorted wake model of a hovering rotor
[NASA-TM-81258] N81-20030
Recent progress in V/STOL aircraft technology
[NASA-TM-81281] N81-20066
Computation of unsteady turbulent boundary layers with flow reversal and evaluation of two separate turbulence models
[NASA-TM-81259] N81-20384
Surface penetrators for planetary exploration: Science rationale and development program
[NASA-TM-81251] N81-21000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. HUGH L. DRYDEN FLIGHT RESEARCH CENTER, EDWARDS, CALIF.

Diversity techniques for omnidirectional telementry coverage of the HiMAT research vehicle
[NASA-TP-1830] N81-20074

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. GODDARD SPACE FLIGHT CENTER, ALBUQUERQUE, N. MEX.

Consistency of the standard model of primordial nucleosynthesis: Response to the comment of Olive and Turner
[NASA-TM-82082] N81-20994

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. GODDARD SPACE FLIGHT CENTER, GREENBELT, MD.

Snow water equivalent determination by microwave radiometry
[NASA-TM-82074] N81-20490
ICAP: An Interactive Cluster Analysis Procedure for analyzing remotely sensed data
[NASA-TM-80732] N81-20494
The President's Day cyclone 17-19 February 1979: An analysis of jet streak interactions prior to cyclogenesis
[NASA-TM-82077] N81-20658
Radio Jupiter after Voyager: An overview of the Planetary Radio Astronomy observations
[NASA-TM-80718] N81-20988
On the complex state of the interplanetary medium of 28-29 July 1977
[NASA-TM-82095] N81-20996
Fine-scale characteristics of interplanetary sector
[NASA-TM-82281] N81-20997
On the origin of the March 5, 1979 gamma ray transient: A vibrating neutron star in the Large Magellanic Cloud
[NASA-TM-80738] N81-21006

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LANGLEY RESEARCH CENTER, HAMPTON, VA.

Aerodynamic characteristics of a hypersonic cruise aircraft concept with wing-mounted propulsion systems at Mach numbers of 2.96, 3.96 and 4.63
[NASA-TM-81937] N81-20025
A computer technique for detailed analysis of mission radius and maneuverability characteristics of fighter aircraft
[NASA-TP-1837] N81-20026
A pilot training manual for the terminal configured vehicle electronic horizontal situation indicator
[NASA-TM-81959] N81-20044
Operational considerations in utilization of microwave landing system approach and landing guidance
[NASA-TM-81945] N81-20050
An analytical study of the longitudinal response of airplanes to positive wind shear
[NASA-TP-1765] N81-20082
Operating characteristics of the Langley Mach 7 Scramjet Test Facility
[NASA-TM-81929] N81-20083
Support interference of wind tunnel models: A selective annotated bibliography
[NASA-TM-81909] N81-20084
Comments on settling chamber design for quiet, blowdown wind tunnels
[NASA-TM-81948] N81-20085
The Aerospace Vehicle Interactive Design system
[NASA-TM-81957] N81-20167
Analysis and simulation of a magnetic bearing suspension system for a laboratory model annular momentum control device
[NASA-TP-1799] N81-20311
'Finite part' electric and magnetic stored energies for planar antennas
[NASA-TM-81955] N81-20336
Phase control during reconstruction of holographically recorded flow fields using real-time holographic interferometry
[NASA-TM-81953] N81-20405
Laboratory tank studies of a single species of phytoplankton using a remote sensing fluorosensor
[NASA-TP-1821] N81-20492
The 1979 Southeastern Virginia Urban Plume Study. Volume 2: Data listings for NASA Cessna aircraft
[NASA-TM-81860-2] N81-20608
The 1980 direct strike lightning data
[NASA-TM-81946] N81-20668
Description of a digital computer simulation of an Annular Momentum Control Device (AMCD) laboratory test model
[NASA-TM-81797] N81-20741
NASA progress in aircraft noise prediction
[NASA-TM-81915] N81-20830
Scientific and technical information output of the Langley Research Center for calendar year 1980
[NASA-TM-81950] N81-20949

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LEWIS RESEARCH CENTER, CLEVELAND, OHIO.

Reasons for low aerodynamic performance of 13.5-centimeter-tip-diameter aircraft engine starter turbine
[NASA-TP-1810] N81-20076
Diagnostic system design for the Ion Auxiliary Propulsion System (IAPS). Flight tests of two 8 cm mercury ion
[NASA-TM-81702] N81-20172
Analysis of costs of gallium arsenide and silicon solar arrays for space power applications
[NASA-TP-1811] N81-20173
Some effects of thermal-cycle-induced deformation in rocket thrust chambers
[NASA-TP-1834] N81-20176
Simplified power supplies for ion thrusters
[NASA-TM-81725] N81-20177
Recent work on an RF ion thruster
[NASA-TM-81734] N81-20178
Extended operating range of the 30-cm ion thruster with simplified power processor requirements
[NASA-TM-81729] N81-20179
Free radical propulsion concept
[NASA-TM-81770] N81-20180
Effects of geometric variables on rub characteristics of Ti-6Al-4V
[NASA-TP-1835] N81-20245
Dynamics of solid dispersions in oil during the lubrication of point of contacts. Part 2: Molybdenum disulfide
[NASA-TM-81709] N81-20275
Three-axis electron-beam test facility
[NASA-TP-1836] N81-20359
Life analysis of multiroller planetary traction drive
[NASA-TP-1710] N81-20423
Sputtering and ion plating for aerospace applications
[NASA-TM-81726] N81-20424
High-frequency sound propagation in a spatially varying mean flow
[NASA-TM-81751] N81-20831

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. MARSHALL SPACE FLIGHT CENTER, HUNTSVILLE, ALA.
Viscoelastic propellant effects on Space Shuttle Dynamics
[NASA-TM-82403] N81-20289
Summary of Jimsphere wind profiles: Programs, data, comments, part 1
[NASA-CR-161664] N81-20667
The Passive Optical Sample Assembly (POSA) on STS-1
[NASA-TM-82407] N81-20868

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. PASADENA OFFICE, CALIF.
Controller for computer control of brushless dc motors
[NASA-CASE-NPO-13970-1] N81-20352
Multifunctional transducer
[NASA-CASE-NPO-14329-1] N81-20703

NATIONAL AEROSPACE LAB., AMSTERDAM (NETHERLANDS).
On the use of AIDS-data for a statistical analysis of wind shear during the approach N81-20010
Unsteady airloads on a harmonically pitching wing with external store
[NLR-MP-80004-U] N81-20038
A panel method to determine loads on oscillating airfoils in transonic flow with embedded shock waves
[NLR-MP-80005-U] N81-20039
The semi-operational evaluation of the trajectory prediction method for Signal Automatic Radar Processing (SARP) 2
[NLR-MP-79038-U] N81-20059
Engineering properties of the recently developed aluminum alloy designated 7010
[NLR-TR-79017-U] N81-20269
Engineering property comparisons for four AlZnMgCu type forging alloys
[NLR-TR-79022-U] N81-20270
Evaluation of nondestructive inspection methods applied to milled step-down areas. Volume 1: Text and tables
[NLR-TR-78110-U-VOL-1] N81-20450
Evaluation of nondestructive inspection methods applied to milled step-down areas. Volume 2: Figures
[NLR-TR-78110-U-VOL-2] N81-20451
Fundamentals of remote sensing relations between spectral signatures and physical properties of crops
[NLR-MP-79035-U] N81-20527
Image processing techniques using spline approximation N81-20809

NATIONAL BUREAU OF STANDARDS, WASHINGTON, D.C.
Ignition of a liquid fuel under high intensity radiation
[AD-A095691] N81-20223
A reference building approach to building energy performance standards for single-family residences
[PB81-135642] N81-20318
Ultrasonic Materials Characterization
[PB81-124984] N81-20412
Residential solar data center MIRADS user's guide
[PB81-132268] N81-20606
Psychoacoustic evaluation of transmission line audible noise: Building attenuation effects, methodology comparison, and field study feasibility, volume 1
[DOE/RA-29323/1] N81-20833
Data bases available at the National Bureau of Standards library
[PB81-132870] N81-20955
Dimensions/NBS. Volume 64, no. 8, October 1980
[PB81-133654] N81-21007

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, ANN ARBOR, MICH.
New observations on the daily variations of natural ice albedo
[PB81-132789] N81-20532

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, BOULDER, COLO.
A mathematical model for how ionospheric reflection degrades sea-echo spectra
[PB81-108359] N81-20652
Auroral Electrojet magnetic activity indices AE(12) for July-December 1975
[PB81-125551] N81-20653
HF (High Frequency) radar measurements of circulation in the Eastern Strait of Juan de Fuca near Protection Island (July 1979)
[PB81-127490] N81-20690
Synoptic solar magnetic field maps for the interval including Carrington Rotation 1601-1680, May 5, 1973 - April 26, 1979
[PB81-125569] N81-21003

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, MIAMI, FLA.
In-flight calibration of the NOAA/RFC meteorological research aircraft instruments at the Air Force Eastern Test Range, 1977 - 1978
[PB81-132771] N81-20682

NATIONAL TRANSPORTATION SAFETY BOARD, WASHINGTON, D. C.
A technique for recovering nonsynchronized data from a digital flight data recorder N81-20020

NATIONAL WATER WELL ASSOCIATION, WORTHINGTON, OHIO.
Groundwater heat pumps: An examination of hydrogeologic, environmental, legal, and economic factors affecting their use. Volume 2: Appendix D, state hydrogeologic descriptions and maps
[DOE/CS-20060/5120-VOL-2] N81-20398

NAVAL AIR DEVELOPMENT CENTER, WARMINSTER, PA.
Statistical review of counting accelerometer data for Navy and Marine fleet aircraft
[AD-A095617] N81-20070
A continuous corrosivity monitoring device for naval environments
[AD-A095728] N81-20250
Crack propagation in electron beam welded Ti-6Al-4 under spectrum loading conditions
[AD-A095585] N81-20467
An approach to airborne infrared search set performance modeling N81-20805

NAVAL OCEAN SYSTEMS CENTER, SAN DIEGO, CALIF.
Tropospheric refractivity profiles inferred from RF measurements Passive Refractive Index by Satellite Monitoring (PRISM)
[AD-A095498] N81-20643
Statistics for peak values of multiple coherence
[AD-A095460] N81-20795

NAVAL POSTGRADUATE SCHOOL, MONTEREY, CALIF.
Electrode boundary layers in dense, diffuse plasmas
[AD-A095250] N81-20892

NAVAL RESEARCH LAB., WASHINGTON, D. C.
LORI: A multisatellite, multisystem, time-coverage analysis program
[AD-A095537] N81-20148
Deformation microstructure developed during fatigue crack propagation in type 316 stainless steel at 593 deg C
[AD-A095387] N81-20246
Comparative tests between TIESPAD and SPA-66 radar display
[AD-A095643] N81-20340
Self-consistent nonlinear slow-time scale formulation and simulation of overmoded gyrotron oscillators and amplifiers
[AD-A095360] N81-20361
A quantitative Schlieren system for measuring radial density profiles of reduced density channels in gases
[AD-A095295] N81-20407
Laser-initiated, reduced density channels for transporting charged particle beams
[AD-A095725] N81-20415
Evidence for self-focusing or filamentation from X-ray, 3/2 omega 0, and 2 omega 0 emission
[AD-A095450] N81-20416
Anomalous visible emission observed from the rear side of laser irradiated thin transparent targets
[AD-A095563] N81-20417
Naval structural materials: Requirements, issues, and opportunities
[AD-A095724] N81-20466
A look at remote sensing of the ocean temperature structure
[AD-A095644] N81-20524
The equatorial latitude of auroral activity 1972 - 1977
[PB81-132912] N81-20654
Breaking solutions of the variable coefficient Korteweg-deVries equation
[AD-A095247] N81-20687
A FORTRAN computer program for calculating the propagation of plane, cylindrical or spherical finite amplitude waves
[AD-A095386] N81-20832
Characteristics of ablation plasma from planar, laser-driven targets
[AD-A095667] N81-20891

NAVAL SURFACE WEAPONS CENTER, DAHLGREN, VA.
The influence of roll orientation-dependent aerodynamics on the stability of cruciform missile configurations
[AD-A095269] N81-20151

NEVADA UNIV. SYSTEM, RENO.
Basin development and water allocation
[PB81-127276] N81-20534

NEW JERSEY INST. OF TECH., NEWARK
Simulation of aeroheating or aerocooling Air Force stores by arrays of impinging jets
[AD-A095464] N81-20034

NEW MEXICO STATE UNIV., LAS CRUCES.
D-region electron density measurements obtained by partial reflection techniques
[AD-A095566] N81-20644

NEW MEXICO UNIV., ALBUQUERQUE.
Optimization of storage in passive solar heating systems
[DOE/CS-35405/T1] N81-20574

NEW ORLEANS UNIV., LA.
A study of gas solid reactions and air pollution detectors
[AD-A095253] N81-20610

NEW YORK UNIV., N. Y.
Non-adiabatic capture of mobile electrons in aqueous solution
[AD-A095524] N81-20836

NEW ZEALAND ENERGY RESEARCH AND DEVELOPMENT COMMITTEE, AUCKLAND.
Engineering study of pelleting waste paper for energy recovery
[NZERDC-53] N81-20562

NICHOLS RESEARCH CORP., HUNTSVILLE, ALA.
Atmospheric effects on low-power laser beam propagation
[AD-A095383] N81-20418

NIELSEN ENGINEERING AND RESEARCH, INC., MOUNTAIN VIEW, CALIF.
Transonic flow past projectiles with variable nonaxisymmetric cross section
[AD-A095376] N81-20033

NORTH CAROLINA STATE UNIV., RALEIGH.
Optimal linear approximation in project compression
[AD-A095757] N81-20799

NORTH CAROLINA UNIV. AT CHAPEL HILL.
Applications of microcomputers to spectroscopy and electrochemistry N81-20209
The closeness of uniform random points in a square and a circle
[AD-A095697] N81-20772
On a class of multivariate negative binomial distributions
[AD-A095445] N81-20793

NORTH CAROLINA WATER RESOURCES RESEARCH INST., RALEIGH.
Water resources in North Carolina
[PB81-127318] N81-20533

NORTH DAKOTA STATE UNIV., FARGO.
Laser spectroscopy: Rare-earth crystals and crystals in solution N81-20913

NORTHEAST-MIDWEST INST., WASHINGTON, D.C.
Water resource priorities for the midwest
[PB81-129801] N81-20315

NORTHWESTERN UNIV., EVANSTON, ILL.
Hypoxia in the walls of large blood vessels N81-20706
A formal methodology using attributed grammar for multiprocessing system design N81-20736
Parallel solution of large sparse linear equations using a processor network N81-20754
Nonlinear optical effects in liquid crystals
[AD-A095368] N81-20934

NORWEGIAN DEFENCE RESEARCH ESTABLISHMENT, KJELLER.
Image enhancement in real time N81-20813

NOVAR ELECTRONICS CORP., BARBERTON, OHIO.
A theoretical study of microwave beam absorption by a rectenna
[NASA-CR-160921] N81-20328

A theoretical study of microwave beam absorption by a rectenna, introduction N81-20329
Plane wave derivation N81-20330
Current sheet model N81-20331
Waveguide model N81-20332
Grating lobes N81-20333
Tolerence and perturbation analysis N81-20334
Tropospheric/ionospheric transmission tests N81-20335

O

OAK RIDGE NATIONAL LAB., TENN.
Production of ammonia in a packed-bed anaerobic upflow (ANFLOW) bioreactor
[CONF-801104-10] N81-20294
Environmetrics of synfuels. 1: Processing the automated PDP-11 data components for the UMD gasifier facility
[ORNL/TM-7428] N81-20305
High voltage research (breakdown strengths of gaseous and liquid insulators) and environmental effects of dielectric gases
[ORNL/TM-7624] N81-20366
Data format translation routines
[ORNL/CSD/TM-137] N81-20752
Solution of homogeneous systems of linear equations arising from compartmental models
[ORNL/CSD-70] N81-20778
Study of the ionization of C, N, O, Nr, Kr and Xe positive ions by electron impact
[ORNL-TR-4702] N81-20841
Approach to ignition of Tokamak reactors
[ORNL/TM-7552] N81-20897
Plasma fluctuation measurements in ELMO Bumpy Torus
[ORNL/TM-7530] N81-20898
Neoclassical current effects in neutral beam-heated Tokamaks
[ORNL/TM-7611] N81-20899
OFFICE NATIONAL D'ETUDES ET DE RECHERCHES AEROSPATIALES, PARIS (FRANCE).
Space vehicle atmospheric reentry trajectories N81-20140
OFFICE OF SCIENCE AND TECHNOLOGY, WASHINGTON, D. C.
Carbon/graphite composite material study
[NASA-CR-164084] N81-20189
OHIO STATE UNIV., COLUMBUS.
Electromagnetic scattering by open circular waveguides
[AD-A095554] N81-20345
Applied research in analytical photogrammetry
[PB81-127300] N81-20530
OHIO UNIV., ATHENS.
Loran-C plotting program for plotting lines of position on standard charts
[NASA-CR-164082] N81-20052
Automatic gain control
[NASA-CR-164082] N81-20053
OKLAHOMA STATE UNIV., STILLWATER.
Polynuclear aromatic compounds. Synthesis and purification
[PB81-125015] N81-20182
Finned tube heat exchangers: State of the art for the air side
[CONF-800451-3] N81-20399
OKLAHOMA UNIV., NORMAN.
Combustion of drops and sprays of heavy fuel oils and their emulsions
[AD-A095612] N81-20220
OREGON STATE UNIV., CORVALLIS.
Application of linear quadratic control in reduction of aerodynamic forces on aircraft N81-20061
Identification of irrigation practices using photographic and optical-mechanical scanning remote sensing techniques N81-20487
OREGON UNIV., EUGENE.
Atomic inner-shell processes
[AD-A095415] N81-20837
Quark and gluon decay functions in QCD and recombination model
[DOE/ER-70004/266] N81-20845
OXFORD UNIV. (ENGLAND).
Study of direct single photons and correlated particles in proton-proton collisions at square roots = 62-4 GeV (CCOR collaboration)
[DOE/ER-02232/94] N81-20842
Measurement of the transverse momenta of partons and of jet fragmentation as a function of square roots in p-p collisions: CCOR Collaboration
[DOE/ER-02232/92] N81-20853

P

PARKER (LEE W.), INC., CONCORD, MASS.
Airborne lightning warning systems: A survey
[AD-A095354] N81-20045
PATTERN ANALYSIS AND RECOGNITION CORP., ROME, N. Y.
Advanced Query Facility
[AD-A095717] N81-20950
PENNSYLVANIA STATE UNIV., UNIVERSITY PARK.
The prediction of normal force and rolling moment coefficients for a spinning wing
[NASA-CR-165680] N81-20068
Classification of petroleum samples from gas chromatographic data by pattern recognition techniques and simulation of mass spectra by regression analysis of structural descriptors N81-20202
A study of flame spreading and combustion processes in solid propellant cracks N81-20214
The high resolution imaging atom-probe with application to nickel platings
[AD-A095254] N81-20251
Fourier transform infrared spectroscopic studies on the thermal degradation of polyacrylonitrile copolymers
[AD-A095270] N81-20277
The development and evaluation of an automated reflectance microscope system for the petrographic characterization of bituminous coals N81-20488
Geology and geochronology of the Halloran Hills, southeastern California, and implications concerning mesozoic tectonics of the southwestern Cordillera N81-20628
Simple estimation procedures based on rank tests for the one- and two-sample location models N81-20791
Quantitative schlieren analysis of acoustic interaction with submerged plates N81-20828
Ultrasonic attenuation in normal and superconducting indium N81-20918
The role of positional disorder in ferroelectric relaxors N81-20923
A strong coupled electron-acoustic phonon system in one dimension N81-20925
Superstructure phonons and their characterization by Raman Spectroscopy N81-20929
PENNSYLVANIA UNIV., PHILADELPHIA.
Modularity in non-procedural languages through abstract data types
[AD-A095546] N81-20748
Experimental and theoretical studies of donor-type graphite intercalated compounds
[AD-A095282] N81-20935
PHILIPS RESEARCH LABS., REDHILL (ENGLAND).
Real-time grey-level histogram manipulation N81-20807
PHILIPS ZENTRALLABORATORIUM G.M.B.H., HAMBURG (WEST GERMANY).
Integrated thin-film light modulation lines and matrices
[BMFT-FB-T-80-013] N81-20877
PHOTOMETRICS, INC., LEXINGTON, MASS.
Aircraft program for target, background, and sky radiance measurements
[AD-A095363] N81-20646
PITTSBURG AND MIDWAY COAL MINING CO., ENGLEWOOD, COLO.
Solvent Refined Coal (SRC) process: Trace elements research and development. Volume 3: Pilot plant development work, part 6: The fate of trace elements in the SRC process
[DOE/ET-10104/T11] N81-20308
PLESSEY CO. LTD., TOWCESTER (ENGLAND).
Study of a real-time X-Y addressable spatial filter
[CD-6500621/3] N81-20154
PRATT AND WHITNEY AIRCRAFT, WEST PALM BEACH, FLA.
Extended frequency turbofan model
[NASA-CR-165261] N81-20078
PRATT AND WHITNEY AIRCRAFT GROUP, WEST PALM BEACH, FLA.
Concept definition: Retirement for cause of F-100 rotor components
[AD-A095584] N81-20080
High speed cylindrical roller bearing development
[AD-A095357] N81-20437
PRC ENERGY ANALYSIS CO., LOS ANGELES, CALIF.
Satellite Power System (SPS) utility integration: Institutional, planning and operational issues
[EAC-R-4015] N81-20596
PRINCETON UNIV., N. J.
Results on the performance of a broad hand focusing Cherenkov counter
[COO-3072-119] N81-20410
Direct narrow line tuning of a high power CO2 laser
[PPPL-1736] N81-20421
Energy principle with global invariants N81-20879
PURDUE UNIV., LAFAYETTE, IND.
Mechanisms of elevated temperature rupture in single phase ceramics
[DOE/ER-10591/1] N81-20280
Measurements of a separating turbulent boundary layer
[AD-A095252] N81-20394
Measurements of the transverse velocity of a separating turbulent boundary layer
[AD-A095256] N81-20395
Green River Basin flow forecasting models
[PB81-124448] N81-20529
Indiana five-year water resources research and development plan. Fiscal years 1982 - 1986
[PB81-121253] N81-20621
Hybrid approaches and industrial applications of pattern recognition
[AD-A095562] N81-20763

R

RADIATION MONITORING DEVICES, INC., WATERTOWN, MASS.
Low cost, sprayed CdTe solar cell research
[SERI/PR-8104-3-T2] N81-20585
RADIO TECHNICAL COMMISSION FOR AERONAUTICS, WASHINGTON, D. C.
Minimum operational performance standards for airborne radar approach and beacon systems for helicopters
[RTCA/DO-172] N81-20322
Minimum operational performance standards for airborne weather and ground mapping pulsed radars
[RTCA/DO-173] N81-20323
RENSSELAER POLYTECHNIC INST., TROY, N. Y.
Adaptive spread spectrum receiver using acoustic surface wave technology
[AD-A095737] N81-20347
Fracture mechanics and dynamic response of structures
[AD-A095272] N81-20469
RESEARCH INST. OF NATIONAL DEFENCE, STOCKHOLM (SWEDEN).
International seismological data center: Procedures to check events through dynamic information and to estimate magnitudes
[FOA-C-20368-T1] N81-20648
RICE UNIV., HOUSTON, TEX.
Balloon Electrical Environment Profiling System (BEEPS)
[AD-A095531] N81-20669
ROCHESTER UNIV., N. Y.
Diffusional creep of multicomponent systems
[COO-2296-22] N81-20474
ROCKEFELLER UNIV., NEW YORK.
Study of direct single photons and correlated particles in proton-proton collisions at square roots = 62-4 GeV (CCOR collaboration)
[DOE/ER-02232/94] N81-20842
Measurement of the transverse momenta of partons and of jet fragmentation as a function of square roots in p-p collisions: CCOR Collaboration
[DOE/ER-02232/92] N81-20853
ROCKWELL INTERNATIONAL CORP., CANOGA PARK, CALIF.
Molten salt coal gasification process development unit, phase 1. Volume 1: PDU operations
[DOE/ET-10296/66-VOL-1] N81-20296

Coal hydrogasification process development
[DOE/ET-10326/27] N81-20304

ROCKWELL INTERNATIONAL CORP., CEDAR RAPIDS, IOWA.
Delta electrical load analysis C-141B JACC/CP Aircraft
[AD-A095659] N81-20071

ROCKWELL INTERNATIONAL CORP., DALLAS, TEX.
Stress analysis of aircraft modifications (C-141B Aircraft). Joint Airborne Communications Center/Command Post (JACC/CP) provisions
[AD-A095634] N81-20072

ROCKWELL INTERNATIONAL CORP., DOWNEY, CALIF.
SPAR 6 experiment report containerless processing of glass experiment 74-42
[NASA-CR-161674] N81-20102
Satellite Power Systems (SPS) concept definition study (Exhibit D). Volume 6, part 1: Cost and Programmatics
[NASA-CR-3397] N81-20537
Space Construction System Analysis. Part 2: Executive summary
[NASA-CR-160902] N81-20797

ROLLS-ROYCE LTD., DERBY (ENGLAND).
The optimum design of by-pass engines with jet mixing
[PNR-90017] N81-20081
The burr must go
[PNR-90042] N81-20442

ROME AIR DEVELOPMENT CENTER, GRIFFISS AFB, N.Y.
Digital image processing for ground target detection, identification and location N81-20824

ROYAL AIRCRAFT ESTABLISHMENT, FARNBOROUGH (ENGLAND).
Leading-edge separation from a slender rolling wing-body combination
[RAE-TR-80039] N81-20040
Experiments using a three-component laser-anemometry system on a subsonic flow with vorticity
[RAE-TR-80081] N81-20089
Analyses of the US Navy orbits of 1963-24B and 1974-34A at 15th order resonance
[RAE-TR-80093] N81-20142
An investigation of high frequency propagation over an auroral sub-auroral path
[RAE-TM-RAD-NAV-136] N81-20350
Evaluation of the wedge cleavage test for assessment of durability of adhesive bonded joints
[RAE-TM-MAT-349] N81-20479
The effects of repair patches on the stress distribution in a cracked sheet
[RAE-TR-80098] N81-20480

ROYAL INST. OF TECH., STOCKHOLM (SWEDEN).
Silver-iron batteries
[STU-78-4981] N81-20597
Electric fields in the magnetosphere
[TRITA-EPP-80-06] N81-20651
On the determination of boundary collocation points for solving some problems for the Laplace operator
[TRITA-NA-8006] N81-20782
Research during 1979 in plasma physics and controlled fusion
[TRITA-PFU-80-01] N81-20890
Energization of electrons in a plasma beam entering a curved magnetic field
[TRITA-EPP-80-09] N81-20909
Neutron spectra from beam-heated fusion plasmas. Research and Training Program on Controlled Thermonuclear Fusion and Plasma Physics (EUR-NE)
[TRITA-PFU-80-09] N81-20910

ROYAL SIGNALS AND RADAR ESTABLISHMENT, MALVERN (ENGLAND).
A detection and processing scheme for moving target detection using a passive sensor N81-20815

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, N. J.
A study of dispersion processes and climatology from the TWERL Balloon experiment N81-20022
Subsonic axisymmetric base flow control using boundary layer thickness and near-wake mass balance variations N81-20024
Experimental and theoretical investigations on the influence of shear in double diffusive convection N81-20376
Stability of rotational Couette flow of density stratified fluids N81-20380
Numerical studies of transport quantities in one- and two-dimensional disordered systems N81-20915
An investigation of Tkachenko waves in rotating He2 N81-20916
Temperature dependences of hyperfine fields at SP-impurities in fcc-cobalt studied by nuclear spin precession following heavy-ion reactions N81-20926

S

SANDIA LABS., ALBUQUERQUE, N. MEX.
Reaction rates of atmospheric gases with Lithium (Silicon) alloy
[SAND-80-1363] N81-20234
Interaction between computational modelling and experiments for vacuum consumable arc remelting
[SAND-80-1177C] N81-20257
MARIAH: A finite element computer program for incompressible porous flow problems
[SAND-79-1623] N81-20402
Insert type milling cutter evaluation
[SAND-80-2185C] N81-20439
Plastic analysis of randomly distributed grains in a tensile specimen
[SAND-80-2780] N81-20473
Comparative assessment of five potential sites for hydrothermal-magma systems: Summary
[DOE/TIC-11303] N81-20525
Handbook for calculating solar-influenced building heat losses
[SAND-79-2173] N81-20583
Mobile digital data acquisition and recording system for geoenergy process monitoring and control
[SAND-80-2123] N81-20584
Collocation method for the solution of the neutron transport equation with both symmetric and asymmetric scattering
[SAND-80-1446] N81-20843
One-dimensional space-charge neutralization of the ion beams
[SAND-80-2545] N81-20844
Transient analysis of vibrations in nonideal multilayered piezoelectric devices
[SAND-80-1909] N81-20937
Modular file-structured databasing system
[SAND-80-2336C] N81-20953

SCHOOL OF AEROSPACE MEDICINE, BROOKS AFB, TEX.
Nuclear survivability/vulnerability of aircrews: An experimental approach
[AD-A095501] N81-20729

SCIENCE APPLICATIONS, INC., HUNTSVILLE, ALA.
Wind profiles for Space Shuttle loads analysis
[NASA-CR-161676] N81-20666

SCIENTIFIC RESEARCH ASSOCIATES, INC., GLASTONBURY, CONN.
A three-dimensional turbulent compressible subsonic duct flow analysis for use with constructed coordinate systems
[NASA-CR-3389] N81-20383

SIEMENS A.G., MUNICH (WEST GERMANY).
Crystal defects in large scale integrated circuits of silicon
[BMFT-FB-T-79-156] N81-20369
High power amplifier 14 GHz for satellite ground stations
[BMFT-FB-T-79-158] N81-20370
Tantalum aluminum thin film technology for a new generation of microwave integrated circuit applications
[BMFT-FB-T-80-015] N81-20372
Development of a parametric amplifier for satellite transponder applications at 14 to 14.5 GHz
[BMFT-FB-W-79-27] N81-20375
Solid state imagers
[BMFT-FB-T-80-009] N81-20875

SKF INDUSTRIES, INC., KING OF PRUSSIA, PA.
Dry lubrication of high temperature silicon nitride rolling contacts
[AD-A095202] N81-20435

SMITHSONIAN ASTROPHYSICAL OBSERVATORY, CAMBRIDGE, MASS.
Study of certain launching techniques using long orbiting tethers
[NASA-CR-164060] N81-20107
Research of the state of convection in the Earth's mantle
[NASA-CR-163989] N81-20639

SMITHSONIAN INSTITUTION, WASHINGTON, D. C.
Analogs of Martian eolian features in southwestern Egypt N81-20640

SOCIETE CROUZET, VALENCE (FRANCE).
Development of hybrid circuits
[DH-RS-01] N81-20374

SOCIETE NATIONALE INDUSTRIELLE AEROSPATIALE, LES MUREAUX (FRANCE).
Spacecraft launching N81-20123

SONOBOND CORP., WESTCHESTER, PA.
Ultrasonic weld sealing of M55 stab detonators
[AD-A095343] N81-20436

SOUTHERN METHODIST UNIV., DALLAS, TEX.
Measurements of a separating turbulent boundary layer
[AD-A095252] N81-20394
Measurements of the transverse velocity of a separating turbulent boundary layer
[AD-A095256] N81-20395

SOUTHWEST RESEARCH INST., SAN ANTONIO, TEX.
Explosibility of energetic material dusts
[AD-A095353] N81-20288
Thin film strain transducer
[NASA-CR-156875] N81-20406

SPACE OPTICS RESEARCH LABS., INC., CHELMSFORD, MASS.
Schwarzschild camera
[NASA-CR-160061] N81-20864

SRI INTERNATIONAL CORP., MENLO PARK, CALIF.
Lidar observations at 0.7 micrometers and 10.6 micrometers wavelengths during Smoke Week 2
[AD-A095356] N81-20341
Measurements of possible D- and E-region telecommunications effects during ionospheric heating
[DOE/ER-10161/1] N81-20349
Consultation for the H2S and meteorological monitoring program of the Ente Nazional per l'Energia Elecrtrica (ENEL)
[DOE/ET-28502/1] N81-20680

STANFORD LINEAR ACCELERATOR CENTER, CALIF.
Proceedings of the Beam-Beam Interaction Seminar
[SLAC-PUB-2624] N81-20856

STANFORD UNIV., CALIF.
Development of combustion diagnostics and application to turbulent combustion
[AD-A095719] N81-20219
ULF/lower-ELF electromagnetic field measurements in the polar caps
[AD-A095283] N81-20343
Density measurement in air with a saturable absorbing seed gas
[NASA-CR-164063] N81-20641
Efficient algorithms for certain satisfiability and linear programming problems
[AD-A095411] N81-20744
A feasibility study on the growth of bulk GaN single crystals
[AD-A095567] N81-20931
A feasibility study on the growth of bulk GaN single crystals
[AD-A095553] N81-20932

STATE UNIV. OF NEW YORK AT STONY BROOK.
On the motions of particles in turbulent flows N81-20389
Time-average optical methods for strain analysis N81-20453

STATENS RAD FOER BYGGNADSFORSKNING, STOCKHOLM (SWEDEN).
Energy conservation in houses built from 1960
[SIB-R-4-1980] N81-20569

STICHTING MATHEMATISCH CENTRUM, AMSTERDAM (NETHERLANDS).
On bounds for the specification of finite data types by means of equations and conditional equations
[MC-IW-131/80] N81-20781

STUTTGART UNIV. (WEST GERMANY).
Optical gain in semiconductor lasers
[BMFT-FB-T-79-167] N81-20422

SWEDISH COUNCIL FOR BUILDING RESEARCH, STOCKHOLM.
Optimal distribution of thermal insulation and ground heat losses
[PB81-122871] N81-20317

Flat plate thermal solar collectors: A physical background
[PB81-135741] N81-20605

SWEDLOW, INC., GARDEN GROVE, CALIF.
Molding of polypropylene film armor for radar antenna hardening applications
[AD-A095726] N81-20342

SYRACUSE UNIV., N. Y.
Extension of Volterra analysis to weakly nonlinear electromagnetic field problems with application to whistler propagation N81-20319
Multiple finite source queueing model with fixed priority scheduling N81-20756
A Monte Carlo comparison of robust and resistant estimators of bivariate correlation N81-20785

SYSTEMS AND APPLIED SCIENCES CORP., RIVERDALE, MD.
Performance of the discrete Fourier Transform satellite imagery classification technique
[AD-A095364] N81-20670
Star network distributed computer systems evaluation results
[AD-A095687] N81-20743

SYSTEMS SCIENCE AND SOFTWARE, LA JOLLA, CALIF.
Precharge enhanced SGEMP
[AD-A095503] N81-20150

T

TDK ELECTRONICS CO. LTD., ICHIKAWA (JAPAN).
Microstructure and properties of step aged rare Earth alloy magnets
[LBL-11680] N81-20938

TECHNICAL COOPERATION PROGRAM, REDSTONE ARSENAL, ALA.
Hardware implementations of Fourier Transform signal processing
[PB81-123200] N81-20351

TECHNICAL PLANNING, INC., BELTSVILLE, MD.
Coordination and management tasks for the IEA solar heating and cooling program and CCMS solar energy pilot study
[DOE/CS-30108/T3] N81-20567

TECHNISCHE HOCHSCHULE, AACHEN (WEST GERMANY).
Identification of jet engine damages by engine trend analysis LEADS 200 data N81-20014
Some effects of compressor fouling on the behavior of a turbojet engine N81-20015

TECHNISCHE PHYSISCHE DIENST TNO-TH, DELFT (NETHERLANDS).
The benefits of advanced heat storage systems N81-20551
A method to tune the various components of a solar heating system N81-20552

TECHNISCHE UNIVERSITAET, BRUNSWICK (WEST GERMANY).
Digital filtering of PCM-recorded flight data for wind-processing N81-20009
Wind shear measuring on board an airliner N81-20011
Magnetospheric sounding rocket program: The magnetometer experiment in the substorm phenomena payload
[BMFT-FB-W-79-34] N81-20649

TECHNISCHE UNIVERSITAET, MUNICH (WEST GERMANY).
flight data recording and data processing for light airplanes and gliders N81-20008

***TECHNO SYSTEM DEVELOPMENTS, NAPLES* (ITALY).**
Study on fluid phenomena influencing the design of zero-gravity experiments, volume 1
[TS-1-80-VOL-1] N81-20105
Study on fluid phenomena influencing the design of zero-gravity experiments. Volume 2: Users' guide
[TS-11-79-VOL-2] N81-20106

TECHNOLOGY SERVICE CORP., SANTA MONICA, CALIF.
Further development of new methods for estimating tail probabilities and extreme value distributions
[AD-A095721] N81-20794

TENNESSEE UNIV., KNOXVILLE.
Production of ammonia in a packed-bed anaerobic upflow (ANFLOW) bioreactor
[CONF-801104-10] N81-20294

TENNESSEE UNIV. SPACE INST., TULLAHOMA.
Analysis of the inversion monitoring capabilities of a monostatic acoustic radar in complex terrain
[NASA-CR-3401] N81-20664

TEXAS A&M UNIV., COLLEGE STATION.
Hot atom reactions involving multivalent and univalent species
[DOE/ER-03898/52] N81-20854

TEXAS UNIV. AT AUSTIN.
Optimal risk-based design of water resource engineering projects
[PB81-136202] N81-20316

TEXTRON BELL HELICOPTER, FORT WORTH, TEX.
Development and validation of cryogenic foam insulation for LH2 subsonic transports
[NASA-CR-3404] N81-20312
The Data from Aeromechanics Test and Analytics, Management and Analysis Package (DATAMAP). Volume 1: User's manual
[AD-A095188] N81-20745

TOLEDO METROPOLITAN AREA COUNCIL OF GOVERNMENTS, OHIO.
Groundwater as an alternative energy source for space heating and cooling, geothermal heat extraction
[DOE/TIC-11357] N81-20571

TRI-CON ASSOCIATES, INC., CAMBRIDGE, MASS.
Design, fabrication and testing of a satellite electron beam system
[AD-A095362] N81-20362

TRI-STATE REGIONAL PLANNING COMMISSION, NEW YORK.
Energy emergency contingency plan
[PB81-128704] N81-20604

TRW DEFENSE AND SPACE SYSTEMS GROUP, REDONDO BEACH, CALIF.
Symmetric tandem mirror program
[DOE/ET-51017/T1] N81-20894

TRW, INC., CLEVELAND, OHIO.
Forging of powder metallurgy gears
[AD-A095556] N81-20247

U

UNITED KINGDOM ATOMIC ENERGY AUTHORITY, RISLEY (ENGLAND).
Life prediction methods for the combined creep-fatigue endurance
[ND-R-471(R)] N81-20471

UNITED TECHNOLOGIES CORP., SOUTH WINDSOR, CONN.
High-reliability gas turbine combined-cycle development program, phase 1. Volume 2: Appendixes
[EPRI-AP-1599-VOL-2] N81-20434
Evaluation of battery converters based on 4.8-MW fuel cell demonstrator inverter
[DOE/RA-26931/01] N81-20575

UNIVERSITY OF SOUTHEASTERN MASSACHUSETTS, NORTH DARTMOUTH.
Image processing
[AD-A095552] N81-20764

UTAH UNIV., SALT LAKE CITY.
Thermal lens calorimetry N81-20204
Applied research and evaluation of process concepts for liquefaction and gasification of western coals
[DOE/ET-10527/T1] N81-20292

V

VARIAN ASSOCIATES, PALO ALTO, CALIF.
The 200 kV linear beam switch tube development
[AD-A095505] N81-20363
Further development of a novel solar cell concentrator photovoltaic converter system
[SAND-80-7072] N81-20572

VEREINIGTE FLUGTECHNISCHE WERKE G.M.B.H., BREMEN (WEST GERMANY).
Teamwork in target Acquisition N81-20808

VIAK A.B., VAELLINGBY (SWEDEN).
Energy out of groundwater
[NE/HETV-80/9] N81-20565

VIRGINIA POLYTECHNIC INST., BLACKSBURG.
The reduced order model problem in distributed parameter systems adaptive identification and control
[NASA-CR-164059] N81-20761

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG.
Calculation of the room-temperature shapes of unsymmetric laminates
[NASA-CR-163993] N81-20184
A general dynamic synthesis for complex structures composed of substructures N81-20455
The petrology and geochemistry of the Baltimore Mafic Complex, Maryland N81-20627
Simulated lumped-parameter system reduced-order adaptive control studies
[NASA-CR-163992] N81-20760
Bayesian optimal designs for surveillance procedures in attribute life testing
[AD-A095723] N81-20796

VIRGINIA UNIV., CHARLOTTESVILLE.
Metal-metastable energy transfer for atomic luminescence N81-20203
Studies in chemical ionization mass spectrometry N81-20208
Microscopic processes in the ductile fracture of precipitation hardened A1-1.79 W/O Cu alloys N81-20240
Improvements in the electrolytic generation of hydrogen N81-20287
Applications of CCD and SAW devices to image processing N81-20357
Boundary-layer structure over the tropical ocean N81-20683
The minimax finite-element method N81-20771

VISIDYNE, INC., BURLINGTON, MASS.
Balloonborne lidar experiment
[AD-A095366] N81-20642

VOLVO FLYGMOTOR A.B., TROLLHAETTAN (SWEDEN).
Development of method and equipment for energy recovery from the exhaust gases of the oil-fueled smelting and holding furnaces
[STU-78-6895] N81-20573

VON KARMAN INST. FOR FLUID DYNAMICS, RHODE-SAINT-GENESE (BELGIUM).
Measurements and predictions of complex turbulent flows, volume 2
[VKI-LS-1980-3-VOL-2] N81-20385
Turbulent mixing and concentration measurement N81-20390
Optical measurements of the diffusion of a heavy gas in turbulent boundary layer N81-20391
Hot wire techniques: Conditional sampling and intermittency N81-20393
Steam turbines for large power outputs
[VKI-LS-1980-6] N81-20426
Heat exchange and solar energy, volume 2
[VKI-LEC-SER-1980-2-VOL-2] N81-20549
System modeling using TRNSYS computer simulation N81-20555

W

WASHINGTON STATE UNIV., PULLMAN.
Solvent Refined Coal (SRC) process: Trace elements research and development. Volume 3: Pilot plant development work, part 6: The fate of trace elements in the SRC process
[DOE/ET-10104/T11] N81-20308

WASHINGTON UNIV., SEATTLE.
The generalized standard addition method: Intermetallic interferences in anodic stripping voltammetry
[AD-A095419] N81-20222
A unified theory of linear diffusion in multilayered materials N81-20381
Dynamic piping fracture coupled with system effects
[EPRI-NP-1640] N81-20470
Correlation of aligned angular momentum with scattering angle and energy loss in deeply inelastic collisions
[DOE/ER-01388/464] N81-20840

WEIZMANN INST. OF SCIENCE, REHOVOTH (ISRAEL).
Statistical properties of visible and infrared beams retroreflected through a turbulent atmosphere
[LA-UR-80-3674] N81-20872

***WESTINGHOUSE ELECTRIC CORP.*, PHILADELPHIA, PA.**
Steam turbines for large power outputs N81-20427
Field turbine tests N81-20431

Detection of water induction in steam turbines
[EPRI-CS-1604] N81-20438

WISCONSIN UNIV. - MADISON.
Computer Evaluation of Surface Topography (CEST) and applications to sheet steel finishing processes N81-20237
Kinetics of the degradation of type 316 stainless steel by liquid lithium N81-20239
The calculation of the current-gain of bipolar transistors and the theory for the forward-biased p-n junction at all injection levels N81-20354
Radar investigations of the Ross Ice Shelf N81-20631
A study of topographically-forced surface winds in Antarctica with special emphasis on the katabatic flow at Adelie Land N81-20655
Guaranteed component-wise point-wise error bounds for approximate solutions of nonlinear two-point boundary value problems using an improved Kantorovich-like theorem N81-20740
A method for adaptive performance improvement of operation systems N81-20757
Applications of logic to finite combinatorics N81-20767
Orbits near triple collision in the three body problem N81-20769
Aspects of efficiency robust estimation of location N81-20787
Tests for dependence in multivariate observations N81-20788
Some problems in combinatorial matrix theory N81-20798
Ion heating in the ion cyclotron range of frequencies in the Wisconsin Tokapole 2 N81-20880
Impact of plasma wall interactions on the burn dynamics of Tokamak reactors N81-20883
Drift-cyclotron loss-cone instability in the presence of the external wave fields N81-20885
Commerical tandem mirror reactor design with thermal barriers: WITAMIR-I
[UWFDM-375] N81-20887
Structural and thermodynamic properties of xenon, krypton, and argon adsorbed on silver(111) N81-20924
The nature of the spatial structure of diffuse soft X-rays in the direction of the North Polar Spur N81-21004

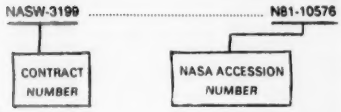
Y

YALE UNIV., NEW HAVEN, CONN.
Conceptual information retrieval
[AD-A095372] N81-20765
Memory, meaning and syntax
[AD-A095451] N81-20951

Z

ZEISS (CARL), OBERKOCHEN (WEST GERMANY).
Laser spectroscopy for the environment
[BMFT-FB-T-80-014] N81-20617
ZINC ALLOY DIE CASTING SOCIETY, NEW DELHI (INDIA).
Die casting
[PB81-123697] N81-20314

Typical Contract Number Index Listing



Listings in this index are arranged alphanumerically by contract number. Under each contract number the NASA accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order. The NASA accession number denotes the number by which the citation is identified.

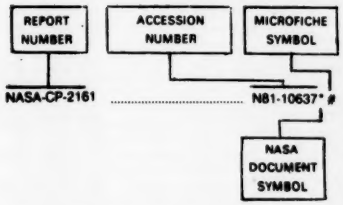
AF PROJ. 2183 ..... N81-20749
AF PROJ. 2301 ..... N81-20414
AF PROJ. 2304 ..... N81-20346
N81-20446
N81-20792
N81-20794
AF PROJ. 2307 ..... N81-20035
N81-20079
AF PROJ. 2308 ..... N81-20219
N81-20223
N81-20892
N81-20893
AF PROJ. 2402 ..... N81-20034
AF PROJ. 2418 ..... N81-20255
AF PROJ. 2526 ..... N81-20737
AF PROJ. 3048 ..... N81-20437
AF PROJ. 3291 ..... N81-20645
AF PROJ. 4506 ..... N81-20363
AF PROJ. 4594 ..... N81-20950
AF PROJ. 5581 ..... N81-20054
AF PROJ. 6670 ..... N81-20670
N81-20676
AF PROJ. 6690 ..... N81-20362
N81-20642
AF PROJ. 7351 ..... N81-20080
AF PROJ. 7600 ..... N81-20057
AF PROJ. 7661 ..... N81-20149
AF PROJ. 7663 ..... N81-20647
AF PROJ. 7670 ..... N81-20646
AF PROJ. 7757 ..... N81-20418
N81-20729
AF-AFOSR-ISSA-0010-80 ..... N81-20223
AF-AFOSR-0122-79 ..... N81-20414
AF-AFOSR-3233-77 ..... N81-20038
AF-AFOSR-3271-77 ..... N81-20446
N81-20792
AF-AFOSR-3695-78 ..... N81-20346
AFOSR MIPR N60921-79 ..... N81-20291
AFOSR MIPR-00618-79 ..... N81-20892
ARO-15812-MS N81-20401
ARPA ORDER 2656 ..... N81-20646
ARPA ORDER 3045 ..... N81-20762
ARPA ORDER 3291 ..... N81-20645
ARPA ORDER 3341 ..... N81-20747
ARPA ORDER 3718 ..... N81-20407
N81-20415
DA PROJ. 1E2-63710-DK-70 ..... N81-20869
DA PROJ. 1L1-61102-AH-42 ..... N81-20190
DA PROJ. 1L1-61102-AH-43 ..... N81-20408
DA PROJ. 1L1-61102-AH-60 ..... N81-20776
DA PROJ. 1L1-61102-BH-57 ..... N81-20777
DA PROJ. 1L1-62105-AH-84 ..... N81-20253
DA PROJ. 1L1-62111-AH-71 ..... N81-20341
DA PROJ. 1L1-62209-AH-76 ..... N81-20745
DA PROJ. 1L1-62701-AH-92 ..... N81-20871
DA PROJ. 1L1-62705-AH-94 ..... N81-20364
N81-20365
DA PROJ. 2Q1-62722-A-765 ..... N81-20344
DA PROJ. 4A1-61101-A-91D N81-20750
DAAB07-77-C-0476 ..... N81-20342
DAAB07-78-C-2922 ..... N81-20870
DAAB07-78-C-2977 ..... N81-20364
DAAD07-79-C-0008 ..... N81-20644
DAAG20-77-G-0226 ..... N81-20610
DAAG20-79-C-0192 ..... N81-20347
DAAG29-76-D-0100 ..... N81-20344
DAAG29-77-C-0001 ..... N81-20341
DAAG29-77-C-0038 ..... N81-20033
DAAG29-77-C-0040 ..... N81-20935
DAAG29-77-G-0009 ..... N81-20934
DAAG29-77-G-0198 ..... N81-20469
DAAG29-77-G-0205 ..... N81-20347
DAAG29-78-C-0003 ..... N81-20777
DAAG29-78-G-0004 ..... N81-20835
DAAG29-78-G-0010 ..... N81-20837
DAAG29-78-G-0074 ..... N81-20221
DAAG29-79-C-0002 ..... N81-20032
DAAG29-79-C-0062 ..... N81-20800
DAAG29-79-C-0211 ..... N81-20799
DAAG29-79-G-0185 ..... N81-20248
DAAG29-80-C-0015 ..... N81-20396
DAAG46-79-C-0052 ..... N81-20253
DAAG46-79-C-0083 ..... N81-20190
DAAK10-77-C-0086 ..... N81-20288
DAAK10-78-C-0430 ..... N81-20436
DAAK20-79-C-0273 ..... N81-20365
DAAK30-78-C-0029 ..... N81-20247
DAAK51-79-C-0015 ..... N81-20745
DAAK70-77-C-0248 ..... N81-20869
DAAK70-80-C-0235 ..... N81-20145
DAAK80-79-C-0771 ..... N81-20871
DASG60-80-C-0010 ..... N81-20743
DE-AC01-76ET-1034 ..... N81-20440
DE-AC01-76ET-10104 ..... N81-20308
DE-AC01-76ET-10527 ..... N81-20292
DE-AC01-76ET-26961 ..... N81-20575
DE-AC01-78CS-20060 ..... N81-20398
DE-AC01-78ET-10328 ..... N81-20304
DE-AC01-79CR-10001 ..... N81-20293
DE-AC01-79CS-30027 ..... N81-20588
DE-AC01-79ER-10041 ..... N81-20596
DE-AC01-80ET-15602 ..... N81-20590
DE-AC02-76CH-00016 ..... N81-20259
N81-20300
N81-20301
N81-20855
N81-20861
DE-AC02-76ER-01198 ..... N81-20256
DE-AC02-76ER-02232 ..... N81-20842
N81-20853
DE-AC02-76ER-03072 ..... N81-20410
DE-AC02-77CH-00178 ..... N81-20570
N81-20585
DE-AC02-78ER-04831 ..... N81-20846
DE-AC02-78ET-29345 ..... N81-20591
DE-AC02-79CS-30108 ..... N81-20587
DE-AC02-79ER-10367 ..... N81-20400
DE-AC02-79ER-10396 ..... N81-20419
DE-AC02-79ET-15422 ..... N81-20560
DE-AC02-79ET-23006 ..... N81-20593
DE-AC02-80ER-10571 ..... N81-20264
DE-AC02-80ER-10591 ..... N81-20280
DE-AC03-76SF-00515 ..... N81-20856
DE-AC03-77ET-10296 ..... N81-20296
DE-AC03-78CS-40023 ..... N81-20441
DE-AC03-79CS-40213 ..... N81-20231
DE-AC03-79ET-51017 ..... N81-20894
DE-AC04-76DP-00053 ..... N81-20279
DE-AC04-76DP-00487 ..... N81-20235
N81-20307
DE-AC04-76DP-00789 ..... N81-20234
N81-20257
N81-20402
N81-20439
N81-20473
N81-20525
N81-20572
N81-20579
N81-20582
N81-20583
N81-20584
N81-20595
N81-20599
N81-20843
N81-20844
N81-20937
N81-20953
DE-AC04-78CS-35351 ..... N81-20568
DE-AC04-79ET-15303 ..... N81-20236
DE-AC06-76ER-01388 ..... N81-20840
DE-AC06-76RL-01830 ..... N81-20258
N81-20577
N81-20578
N81-20582
N81-20679
N81-20834
N81-20858
N81-20939
DE-AC06-80ER-53098 ..... N81-20908
DE-AC07-76ID-01570 ..... N81-20449
N81-20903
DE-AC09-76SR-00001 ..... N81-20228
DE-AC14-76FF-02170 ..... N81-20475
DE-AC22-80PC-30252 ..... N81-20227
DE-AI01-76ET-12548 ..... N81-20495
DE-AI01-76ET-20356 ..... N81-20544
N81-20545
N81-20546
DE-AI01-77CS-51040 ..... N81-20958
DE-AI01-77ET-20344 ..... N81-20263
DE-AI01-80ER-10160 ..... N81-20349
DE-AM02-76CH-03073 ..... N81-20421
DE-AS01-77ET-10505 ..... N81-20232
DE-AS02-76CS-40202 ..... N81-20306
DE-AS02-76ER-02296 ..... N81-20474
DE-AS02-76ET-02887 ..... N81-20850
DE-AS02-76ET-33056 ..... N81-20594
DE-AS02-76ET-52002 ..... N81-20900
DE-AS02-76ET-52040 ..... N81-20902
DE-AS04-78CS-35405 ..... N81-20574
DE-AS05-76ER-03898 ..... N81-20854
DE-AS05-76ET-20312 ..... N81-20399
DE-AS05-78ET-52025 ..... N81-20906
DE-AS22-78ET-03297 ..... N81-20295
DE-AT01-77ET-29323 ..... N81-20833
DE-AT03-76ET-28502 ..... N81-20680
DE-AT03-76ET-35300 ..... N81-20191
DE-AT03-76SF-20235 ..... N81-20689
DE-AT06-76ER-70004 ..... N81-20845
DE-FG01-78ET-10157 ..... N81-20702
DE-FG02-79R5-10130 ..... N81-20566
DEN3-106 ..... N81-20958
DGRST-78.7.0050 ..... N81-20602
DI-14-31-0001-3104 ..... N81-20534
DI-14-31-0001-3612 ..... N81-20534
DI-14-34-0001-7145 ..... N81-20528
DI-14-34-0001-7164 ..... N81-20535
DNA PROJ. R99-QAXEE501 ..... N81-20150
DNA001-79-C-0079 ..... N81-20150
DNA001-80-C-0075 ..... N81-20742
DOT-CG-81-79-2038 ..... N81-20048
DOT-CG-93621-A N81-20220
DOT-FA72-WAI-261 ..... N81-20055
DOT-FH-D-5-15 ..... N81-20286
DOT-OST-80082 ..... N81-20961
DOT-RC-82007 ..... N81-20464
DOT-TSC-1314 ..... N81-20960
E(49-18)-2006 ..... N81-20292
EA-77-A-01-6010 ..... N81-20318

ED-77-A-31-1042 ..... N81-20959
EDA-ERD-699-G-79-33 ..... N81-20315
EDA-99-7-13507 ..... N81-20315
EF-77-S-01-2729 ..... N81-20232
EG-77-C-01-0442 ..... N81-20570
EM-78-C-03-1837 ..... N81-20441
EM-78-C-04-5351 ..... N81-20568
EM-78-S-04-5405 ..... N81-20574
EPA-R-805419 ..... N81-20182
EPA-68-02-1219 ..... N81-20618
EPA-68-03-2636 ..... N81-20531
EPRI PROJ. RP635-2 ..... N81-20591
EPRI PROJ. 231-1 ..... N81-20470
EPRI PROJ. 922-4 ..... N81-20908
EPRI PROJ. 980-5 ..... N81-20302
EPRI PROJ. 1187-1 ..... N81-20434
ESA-2839/76/HP N81-20374
ESA-3412/77 ..... N81-20603
ESA-3766/78/NL-JS(SC) N81-20153
ESA-3772/78/NL-PP(SC) N81-20989
N81-20990
ESA-3951/79/F-DKR(SC) N81-20104
ESA-3986/79/F-CG N81-20526
ESA-4024/79/NL-AK(SC) N81-20165
ESTEC-2873/76/NL-AK(SC) N81-20154
ESTEC-3749/78 ..... N81-20766
ESTEC-3806/78/NI-JS(SC) N81-20309
ET-78-C-01-3026 ..... N81-20702
ET-78-C-01-3125 ..... N81-20304
ET-78-C-01-3297 ..... N81-20295
EW-78-C-02-4984 ..... N81-20591
EX-76-C-01-1806 ..... N81-20440
EX-77-A-34-1015 ..... N81-20361
EY-76-S-02-2793 ..... N81-20594
EY-76-S-02-2982 ..... N81-20306
EY-76-S-06-2230 ..... N81-20845
F-K-82223-78-003-21-001 ..... N81-20036
F-K-82223-78-170-21-001 ..... N81-20036
F04701-80-C-0081 ..... N81-20397
F08603-80-C-0602 ..... N81-20072
F09603-80-C-0602 ..... N81-20071
F19628-75-C-0114 ..... N81-20362
F19628-76-C-0168 ..... N81-20647
F19628-77-C-0097 ..... N81-20647
F19628-77-C-0168 ..... N81-20646
F19628-79-C-0033 ..... N81-20670
F19628-79-C-0060 ..... N81-20149
F19628-79-C-0161 ..... N81-20045
F19628-80-C-0001 ..... N81-20737
F19628-80-C-0002 ..... N81-20055
F19628-80-C-0041 ..... N81-20676
F19628-80-C-0094 ..... N81-20642
F30602-78-C-0232 ..... N81-20363
F30602-78-C-0250 ..... N81-20054
F30602-79-C-0174 ..... N81-20950
F30602-79-C-0262 ..... N81-20749
F30602-80-C-0065 ..... N81-20739
F33615-74-C-5180 ..... N81-20448
F33615-76-C-5172 ..... N81-20060
F33615-77-C-3114 ..... N81-20437
F33615-77-C-5198 ..... N81-20255
F33615-78-C-0115 ..... N81-20046
N81-20047
F33615-78-C-0627 ..... N81-20418
F33615-78-C-2013 ..... N81-20893
F33615-79-C-3417 ..... N81-20034
F49620-77-C-0022 ..... N81-20645
F49620-78-C-0026 ..... N81-20219
F49620-78-C-0057 ..... N81-20035
F49620-79-C-0002 ..... N81-20079
F49620-80-C-0037 ..... N81-20794
GEN. ATOMIC PROJ. 6400 ..... N81-20191
JPL-955456 ..... N81-20538
N81-20539
N81-20540
N81-20541
N81-20542
MDA903-77-C-0370 ..... N81-20290
MDA903-79-C-0497 ..... N81-20747
NAG1-3 ..... N81-20065
NAG1-7 ..... N81-20760
N81-20761
NAG2-36 ..... N81-20641
NAG3-25 ..... N81-20244
NAG8-008 ..... N81-20107
NASA ORDER H-43036B N81-20665
NASA ORDER L-12343B N81-20028
NASA ORDER L-13435B N81-20068
NASA ORDER S-50864A N81-20638
NASW-2342 ..... N81-20090
NASW-2790 ..... N81-20694
NASW-3198 ..... N81-20188
N81-20692
N81-20693
N81-20697
N81-20698
N81-20699
N81-20701
N81-20713
N81-20714
N81-20715
N81-20717
N81-20719
N81-20720
N81-20727
N81-20867
N81-20956
NASW-3199 ..... N81-20031
N81-20103
N81-20144
N81-20187
N81-20217
N81-20543
N81-20609
N81-20691
N81-20695
N81-20696
N81-20700
N81-20716
N81-20721
N81-20725
N81-20726
N81-20728
N81-20802
N81-20866
N81-20889
NAS1-10969 ..... N81-20312
NAS1-14742 ..... N81-20062
NAS1-15325 ..... N81-20062
NAS1-15497 ..... N81-20051
NAS1-16000 ..... N81-20067
NAS1-16176 ..... N81-20027
NAS2-10515 ..... N81-20063
NAS3-21052 ..... N81-20174
NAS3-21607 ..... N81-20078
NAS3-21735 ..... N81-20383
NAS5-20900 ..... N81-20491
NAS5-22961 ..... N81-20864
NAS5-23190 ..... N81-20360
NAS5-24365 ..... N81-20337
NAS5-25134 ..... N81-20338
NAS5-25135 ..... N81-20147
NAS5-25678 ..... N81-20166
NAS5-25772 ..... N81-20638
NAS6-3077 ..... N81-20406
NAS7-100 ..... N81-20168
N81-20339
N81-20495
N81-20544
N81-20545
N81-20546
N81-20547
N81-20548
N81-20686
NAS8-29313 ..... N81-20382
NAS8-32023 ..... N81-20102
NAS8-32031 ..... N81-20664
NAS8-32432 ..... N81-20667
NAS8-32475 ..... N81-20537
NAS8-32839 ..... N81-20666
NAS8-33107 ..... N81-20863
NAS8-33115 ..... N81-20101
NAS8-33553 ..... N81-20175
NAS8-33576 ..... N81-20425
NAS9-13624 ..... N81-20731
NAS9-13940 ..... N81-20324
NAS9-15483 ..... N81-20707
NAS9-15604 ..... N81-20157
N81-20158
NAS9-15671 ..... N81-20865
NAS9-15718 ..... N81-20797
NAS9-15795 ..... N81-20327
NAS9-15950 ..... N81-20722
NAS9-15973 ..... N81-20462
N81-20463
NAS9-16001 ..... N81-20146
NAS9-16055 ..... N81-20328
NATO-1639 ..... N81-20763
NCC1-15 ..... N81-20184
NCC5-10 ..... N81-20639
NGR-05-002-160 ..... N81-21002
NGR-21-002-316 ..... N81-21006
NGR-36-009-017 ..... N81-20052
N81-20053
NGR-39-007-011 ..... N81-20464
NGR-44-095-001 ..... N81-20733
NIVR-1743 ..... N81-20269
N81-20270
NOAA-04-6-158-44110 ..... N81-20404
NR PROJ. 042-422 ..... N81-20764
NR PROJ. 049-383 ..... N81-20762
NR PROJ. 051-539 ..... N81-20218
NR PROJ. 051-565 ..... N81-20222
NR PROJ. 098-038 ..... N81-20394
NR PROJ. 267-037 ..... N81-20730
NSF AST-79-11987 ..... N81-21006
NSF ATM-79-20277 ..... N81-20638
NSF CME-78-08737 ..... N81-20464
NSF ECS-79-08815 ..... N81-20346
NSF ENG-78-05449 ..... N81-20316
NSF ENG-78-13936 ..... N81-20799
NSF ENG-79-02506 ..... N81-20775
NSF ENG-79-05906 ..... N81-20483
NSF ENV-76-04262 ..... N81-20485
NSF ENV-76-04263 ..... N81-20484
NSF IST-79-18463 ..... N81-20951
NSF IST-79-21977 ..... N81-20744
NSF MCS-77-23728 ..... N81-20744
NSF MCS-78-21024 ..... N81-20773
NSF MCS-79-21024 ..... N81-20738
N81-20774
NSF PFR-77-20667 ..... N81-20403
NSF PFR-79-08984 ..... N81-20484
NSG-1295 ..... N81-20465
NSG-1356 ..... N81-20086
NSG-1604 ..... N81-20186
NSG-1606 ..... N81-20185
NSG-5009 ..... N81-20276
NSG-5348 ..... N81-20637
N81-20638
NSG-7486 ..... N81-20640
NSG-7590 ..... N81-20999
NSG-7637 ..... N81-20998
N00014-74-C-0277 ..... N81-20468
N00014-75-C-0397 ..... N81-20836
N00014-75-C-0522 ..... N81-20746
N00014-75-C-0536 ..... N81-20222
N00014-75-C-0564 ..... N81-20933
N00014-75-C-0621 ..... N81-20775
N00014-75-C-0643 ..... N81-20746
N00014-75-C-0809 ..... N81-20772
N81-20793
N00014-75-C-0883 ..... N81-20218
N00014-75-C-0949 ..... N81-20839
N00014-75-C-1111 ..... N81-20765
N81-20951
N00014-75-C-1143 ..... N81-20394
N00014-75-C-1183 ..... N81-20762
N00014-76-C-0041 ..... N81-20838
N00014-76-C-0330 ..... N81-20744
N00014-76-C-0416 ..... N81-20748
N00014-76-C-0826 ..... N81-20224
N00014-77-C-0154 ..... N81-20669
N00014-77-C-0387 ..... N81-20249
N00014-78-C-0049 ..... N81-20345
N00014-78-C-0458 ..... N81-20688
N00014-79-C-0021 ..... N81-20278
N00014-79-C-0128 ..... N81-20730
N00014-79-C-0159 ..... N81-20448
N00014-79-C-0174 ..... N81-20343
N00014-79-C-0277 ..... N81-20395
N00014-79-C-0494 ..... N81-20764
N00014-79-C-0574 ..... N81-20763
N00014-79-C-0731 ..... N81-20252
N00014-80-C-0325 ..... N81-20796
N00014-80-C-0647 ..... N81-20738
N81-20773
N81-20774
N00019-79-C-0327 ..... N81-20931
N81-20932
N00019-79-C-0612 ..... N81-20435
N00024-79-C-6043 ..... N81-20251
N81-20277
N60921-80-WR-W0189 ..... N81-20407
N81-20415
PHS-RR-00292 ..... N81-20227
PROJ. BCT 31 ..... N81-20267
PROJ. SQUID N81-20394
N81-20395
RR02241 ..... N81-20246

RR0110842 ..... N81-20524
N81-20632
RR0110941 ..... N81-20361
N81-20407
RR0140241 ..... N81-20148
RR0310341 ..... N81-20687
SF12141491 ..... N81-20643
SRI PROJ. 8595 ..... N81-20349
STU-78-5542 ..... N81-20192
SWEDBTD-79-6009 ..... N81-20481
W-31-109-ENG-38 ..... N81-20226
N81-20571
N81-20589
N81-20598
N81-20611
N81-20943
W-7405-ENG-26 ..... N81-20294
N81-20305
N81-20366
N81-20752
N81-20778
N81-20897
N81-20898
N81-20899
W-7405-ENG-36 ..... N81-20181
N81-20233
N81-20260
N81-20303
N81-20420
N81-20472
N81-20580
N81-20586
N81-20587
N81-20613
N81-20732
N81-20847
N81-20848
N81-20849
N81-20859
N81-20860
N81-20872
N81-20873
N81-20896
N81-20901
N81-20936
W-7405-ENG-48 ..... N81-20229
N81-20230
N81-20261
N81-20298
N81-20367
N81-20368
N81-20401
N81-20409
N81-20448
N81-20561
N81-20576
N81-20612
N81-20614
N81-20615
N81-20616
N81-20678
N81-20753
N81-20779
N81-20851
N81-20852
N81-20857
N81-20895
N81-20904
N81-20907
N81-20938
W-7405-ENG-82 ..... N81-20262
WF32395 ..... N81-20151
WR0220101 ..... N81-20250
XF11101100 ..... N81-20795
ZF54590001 ..... N81-20467
146-20-10-07 ..... N81-20608
146-40-15-07 ..... N81-20492
186-68-76-07 ..... N81-21000
505-31-23-04 ..... N81-20085
505-31-73-01 ..... N81-20025
505-32-02 ..... N81-20831
505-32-42 ..... N81-20245
N81-20275
N81-20423
505-32-93-01 ..... N81-20083
505-34-11 ..... N81-20006
505-34-13-02 ..... N81-20336
505-41-13-06 ..... N81-20068
505-42-21 ..... N81-20030
505-44-13-02 ..... N81-20688
505-44-23-01 ..... N81-20082
506-51-23-02 ..... N81-20405
506-52-12 ..... N81-20176
506-53-12 ..... N81-20424
506-54-42 ..... N81-20359
506-54-83-01-00 ..... N81-20741
506-54-93-02 ..... N81-20311
506-55-22 ..... N81-20178
506-55-72 ..... N81-20173
506-61-13-02 ..... N81-20167
530-03-13-02 ..... N81-20026
533-03-14 ..... N81-20074
542-05-12 ..... N81-20172
554-04-13-55 ..... N81-20044
992-21-01 ..... N81-20384

REPORT/ACCESSION NUMBER INDEX

Typical Report/Accession Number Index Listing



Listings in this index are arranged alpha-numerically by report number. The NASA accession number denotes the number by which the citation is identified. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche.

A-8412 ..... N81-21000* #
A-8427 ..... N81-20006* #
A-8436 ..... N81-20030* #
A-8438 ..... N81-20384* #
A-8464 ..... N81-20029* #
A-8512 ..... N81-20066* #

AD-A095188 ..... N81-20745 #
AD-A095190 ..... N81-20221 #
AD-A095193 ..... N81-20032 #
AD-A095199 ..... N81-20087 #
AD-A095202 ..... N81-20435 #
AD-A095247 ..... N81-20687 #
AD-A095250 ..... N81-20892 #
AD-A095251 ..... N81-20933 #
AD-A095252 ..... N81-20394 #
AD-A095253 ..... N81-20610 #
AD-A095254 ..... N81-20251 #
AD-A095256 ..... N81-20395 #
AD-A095269 ..... N81-20151 #
AD-A095270 ..... N81-20277 #
AD-A095272 ..... N81-20469 #
AD-A095276 ..... N81-20871 #
AD-A095278 ..... N81-20364 #
AD-A095282 ..... N81-20935 #
AD-A095283 ..... N81-20343 #
AD-A095284 ..... N81-20838 #
AD-A095285 ..... N81-20447 #
AD-A095287 ..... N81-20069 #
AD-A095293 ..... N81-20278 #
AD-A095295 ..... N81-20407 #
AD-A095296 ..... N81-20647 #
AD-A095298 ..... N81-20249 #
AD-A095299 ..... N81-20730 #
AD-A095303 ..... N81-20959 #
AD-A095328 ..... N81-20674 #
AD-A095329 ..... N81-20675 #
AD-A095330 ..... N81-20671 #
AD-A095331 ..... N81-20673 #
AD-A095332 ..... N81-20672 #
AD-A095341 ..... N81-20839 #
AD-A095343 ..... N81-20436 #
AD-A095344 ..... N81-20776 #
AD-A095345 ..... N81-20254 #
AD-A095349 ..... N81-20408 #
AD-A095352 ..... N81-20291 #
AD-A095353 ..... N81-20288 #
AD-A095354 ..... N81-20045 #
AD-A095356 ..... N81-20341 #
AD-A095357 ..... N81-20437 #
AD-A095358 ..... N81-20676 #
AD-A095359 ..... N81-20397 #
AD-A095360 ..... N81-20361 #
AD-A095362 ..... N81-20362 #
AD-A095363 ..... N81-20646 #
AD-A095364 ..... N81-20670 #
AD-A095366 ..... N81-20642 #
AD-A095368 ..... N81-20934 #
AD-A095372 ..... N81-20765 #
AD-A095376 ..... N81-20033 #
AD-A095379 ..... N81-20152 #
AD-A095382 ..... N81-20348 #
AD-A095383 ..... N81-20418 #
AD-A095385 ..... N81-20762 #
AD-A095386 ..... N81-20832 #
AD-A095387 ..... N81-20246 #
AD-A095396 ..... N81-20225 #
AD-A095410 ..... N81-20248 #
AD-A095411 ..... N81-20744 #
AD-A095414 ..... N81-20253 #
AD-A095415 ..... N81-20837 #
AD-A095417 ..... N81-20047 #
AD-A095418 ..... N81-20046 #
AD-A095419 ..... N81-20222 #
AD-A095420 ..... N81-20252 #
AD-A095421 ..... N81-20224 #
AD-A095422 ..... N81-20800 #
AD-A095445 ..... N81-20793 #
AD-A095446 ..... N81-20057 #
AD-A095449 ..... N81-20056 #
AD-A095450 ..... N81-20416 #
AD-A095451 ..... N81-20951 #
AD-A095460 ..... N81-20795 #
AD-A095462 ..... N81-20055 #
AD-A095464 ..... N81-20034 #
AD-A095472 ..... N81-20835 #
AD-A095498 ..... N81-20643 #
AD-A095501 ..... N81-20729 #
AD-A095503 ..... N81-20150 #
AD-A095505 ..... N81-20363 #
AD-A095507 ..... N81-20149 #
AD-A095508 ..... N81-20893 #
AD-A095521 ..... N81-20746 #
AD-A095524 ..... N81-20836 #
AD-A095531 ..... N81-20669 #
AD-A095535 ..... N81-20742 #
AD-A095537 ..... N81-20148 #
AD-A095539 ..... N81-20774 #
AD-A095546 ..... N81-20748 #
AD-A095549 ..... N81-20365 #
AD-A095551 ..... N81-20870 #
AD-A095552 ..... N81-20764 #
AD-A095553 ..... N81-20932 #
AD-A095554 ..... N81-20345 #
AD-A095556 ..... N81-20247 #
AD-A095559 ..... N81-20777 #
AD-A095562 ..... N81-20763 #
AD-A095563 ..... N81-20417 #
AD-A095566 ..... N81-20644 #
AD-A095567 ..... N81-20931 #
AD-A095569 ..... N81-20751 #
AD-A095584 ..... N81-20080 #
AD-A095585 ..... N81-20467 #
AD-A095595 ..... N81-20190 #
AD-A095596 ..... N81-20869 #
AD-A095600 ..... N81-20952 #
AD-A095612 ..... N81-20220 #
AD-A095617 ..... N81-20070 #
AD-A095634 ..... N81-20072 #
AD-A095643 ..... N81-20340 #
AD-A095644 ..... N81-20524 #
AD-A095656 ..... N81-20773 #
AD-A095657 ..... N81-20738 #
AD-A095658 ..... N81-20346 #
AD-A095659 ..... N81-20071 #
AD-A095660 ..... N81-20218 #
AD-A095661 ..... N81-20344 #
AD-A095663 ..... N81-20737 #
AD-A095664 ..... N81-20739 #
AD-A095667 ..... N81-20891 #
AD-A095680 ..... N81-20075 #
AD-A095687 ..... N81-20743 #
AD-A095690 ..... N81-20645 #
AD-A095691 ..... N81-20223 #
AD-A095692 ..... N81-20688 #
AD-A095693 ..... N81-20749 #
AD-A095697 ..... N81-20772 #
AD-A095699 ..... N81-20747 #
AD-A095705 ..... N81-20079* #
AD-A095706 ..... N81-20414 #
AD-A095707 ..... N81-20035 #
AD-A095708 ..... N81-20446 #
AD-A095709 ..... N81-20145 #
AD-A095713 ..... N81-20290 #
AD-A095716 ..... N81-20775 #
AD-A095717 ..... N81-20950 #
AD-A095718 ..... N81-20792 #
AD-A095719 ..... N81-20219 #
AD-A095720 ..... N81-20255 #
AD-A095721 ..... N81-20794 #
AD-A095723 ..... N81-20796 #
AD-A095724 ..... N81-20466 #
AD-A095725 ..... N81-20415 #
AD-A095726 ..... N81-20342 #
AD-A095727 ..... N81-20054 #
AD-A095728 ..... N81-20250 #
AD-A095732 ..... N81-20468 #
AD-A095735 ..... N81-20750 #
AD-A095737 ..... N81-20347 #
AD-A095747 ..... N81-20073 #
AD-A095748 ..... N81-20048 #
AD-A095757 ..... N81-20799 #
AD-A095758 ..... N81-20396 #

AD-E400517 ..... N81-20436 #
AD-E400542 ..... N81-20288 #
AD-E400553 ..... N81-20291 #
AD-E430563 ..... N81-20408 #
AD-E440107 ..... N81-20776 #
AD-E440108 ..... N81-20254 #
AD-E850010 ..... N81-20674 #
AD-E850011 ..... N81-20675 #
AD-E850012 ..... N81-20671 #
AD-E850013 ..... N81-20673 #
AD-E850014 ..... N81-20672 #
AD-E950090 ..... N81-20348 #
AD-E950095 ..... N81-20152 #

AEDC-TR-80-63 ..... N81-20087 #

AFGL-TR-80-0161 ..... N81-20362 #
AFGL-TR-80-0165 ..... N81-20646 #
AFGL-TR-80-0175 ..... N81-20670 #
AFGL-TR-80-0226 ..... N81-20045 #
AFGL-TR-80-0326 ..... N81-20647 #
AFGL-TR-80-0329 ..... N81-20149 #
AFGL-TR-80-0340 ..... N81-20676 #
AFGL-TR-80-0373 ..... N81-20642 #
AFGL-TR-81-0033 ..... N81-20057 #

AFML-TR-80-4038 ..... N81-20255 #

AFOSR-81-0109TR ..... N81-20079* #
AFOSR-81-0111TR ..... N81-20223 #
AFOSR-81-0112TR ..... N81-20035 #
AFOSR-81-0113TR ..... N81-20219 #
AFOSR-81-0133TR ..... N81-20346 #
AFOSR-81-0136TR ..... N81-20794 #
AFOSR-81-0137TR ..... N81-20446 #
AFOSR-81-0139TR ..... N81-20792 #
AFOSR-81-0191TR ..... N81-20645 #
AFOSR-81-1008TR ..... N81-20414 #

AFWAL-TR-80-2072 ..... N81-20437 #
AFWAL-TR-80-2087 ..... N81-20893 #
AFWAL-TR-80-2088 ..... N81-20892 #
AFWAL-TR-80-3105 ..... N81-20034 #
AFWAL-TR-80-4118 ..... N81-20080 #

AGARD-AR-159 N81-20091 #
AGARD-CP-290 N81-20803 #
AGARD-R-678 N81-20461 #
AGARD-R-691 N81-20064 #
AI-M-577 N81-20746 #
ALO-131 N81-20449 #
AMMRC-TR-80-49 N81-20253 #
AMMRC-TR-80-54 N81-20342 #
AMMRC-TR-80-56 N81-20190 #
AMMRC-TR-80-57 N81-20447 #
ANL-CEN-RSD-80-2 N81-20943 #
ANL-CT-80-22 N81-20589 #
ANL/EES-TM-111 N81-20611 #
ANL/OEPM-80-3 N81-20226 #
AR-1 N81-20252 #
AR-1 N81-20585 #
AR-1 N81-20591 #
AR-3 N81-20189* #
ARAP-434 N81-20777 #
ARBRL-TR-02280 N81-20408 #
ARI-RR-1252 N81-20344 #
ARL/PSU/TM-80-227 N81-20277 #
ARL/PSU/TM-80-242 N81-20251 #
ARLCB-TR-80047 N81-20776 #
ARLCB-TR-81001 N81-20254 #
ARLCD-CR-80042 N81-20288 #
ARLCD-CR-80051 N81-20436 #
ARLCD-TR-80058 N81-20291 #
ARO-14280.4-P N81-20934 #
ARO-14625.14-P N81-20935 #
ARO-14732.2-E N81-20469 #
ARO-14944.4-E N81-20033 #
ARO-15004.16-EL N81-20347 #
ARO-15014.3-C N81-20835 #
ARO-15208.14-P N81-20837 #
ARO-15237.3-C N81-20610 #
ARO-15338.9-M N81-20777 #
ARO-15508.5-E N81-20248 #
ARO-15767.1-AE N81-20221 #
ARO-15813.3-E N81-20032 #
ARO-16229.7-M N81-20800 #
ARO-16352.8-M N81-20799 #
ARO-16674.1-E N81-20396 #
ARP-2 N81-20278 #
ASCOT-80-3 N81-20615 #
ASCOT-80-4 N81-20678 #
ATC-101 N81-20055 #
AVRADCOM-TR-80-C-16 N81-20423* #
AVRADCOM-TR-80-C-17 N81-20076* #
AVRADCOM-TR-80-C-19 N81-20245* #
BHT-699-099-025-VOL-1 N81-20745 #
BMFT-FB-T-79-106 N81-20266 #
BMFT-FB-T-79-143 N81-20600 #
BMFT-FB-T-79-150 N81-20267 #
BMFT-FB-T-79-151 N81-20268 #
BMFT-FB-T-79-153 N81-20281 #
BMFT-FB-T-79-156 N81-20369 #
BMFT-FB-T-79-157 N81-20478 #
BMFT-FB-T-79-158 N81-20370 #
BMFT-FB-T-79-167 N81-20422 #
BMFT-FB-T-79-170 N81-20282 #
BMFT-FB-T-79-174 N81-20283 #
BMFT-FB-T-79-180 N81-20443 #
BMFT-FB-T-80-006 N81-20674 #
BMFT-FB-T-80-009 N81-20675 #
BMFT-FB-T-80-010 N81-20371 #
BMFT-FB-T-80-012 N81-20876 #
BMFT-FB-T-80-013 N81-20877 #
BMFT-FB-T-80-014 N81-20617 #
BMFT-FB-T-80-015 N81-20372 #
BMFT-FB-T-80-016 N81-20373 #
BMFT-FB-T-80-026 N81-20940 #
BMFT-FB-T-80-065 N81-20601 #
BMFT-FB-W-79-27 N81-20375 #
BMFT-FB-W-79-34 N81-20649 #
BMFT-FB-W-79-35 N81-20650 #
BMVG-FBWT-79-27 N81-20477 #
BNL-28577 N81-20301 #
BNL-28584 N81-20259 #
BNL-28613 N81-20655 #
BNL-28627 N81-20300 #
BNL-28850 N81-20861 #
BNR-TR-1-D42-07-80 N81-20871 #
BR74711 N81-20040 #
BR75842 N81-20479 #
BR76036 N81-20089 #
BR76042 N81-20142 #
BR76254 N81-20350 #
BR76461 N81-20480 #
BU-250 N81-20041 #
BU-253 N81-20042 #
BU-254 N81-20411 #
BU-257 N81-20043 #
BU-258 N81-20193 #
C-140 N81-20362 #
CAL-79/91-1 N81-20104 #
CALSPAN-6275-A-5 N81-20035 #
CALSPAN-6655-M-1 N81-20676 #
CD-6500621/3 N81-20154 #
CISE-1576 N81-20482 #
CMR-80-1 N81-20932 #
CNES-CT/EMT/MT/MS/208 N81-20143 #
CNES-CT/PRT/SST/SE/349 N81-20313 #
CNES-78/CT/PRT/SST/SE/72 N81-20310 #
CNES-78/CT/PRT/SST/SS/197 N81-20169 #
CNES-79/CT/PRT/SST/SM/331 N81-20155 #
CNES-79/CT/PRT/SST/SS/166 N81-20170 #
CNES-80/CT/PRT/SST/SM/316 N81-20171 #
CNES-80/CT/PRT/SST/SS/162 N81-20444 #
COMPLETION-100 N81-20528 #
CONF-800103-47 N81-20861 #
CONF-800451-3 N81-20399 #
CONF-800480-6 N81-20679 #
CONF-800607-9 N81-20258 #
CONF-800724-58-SUMM N81-20853 #
CONF-800724-59 N81-20842 #
CONF-800881-2 N81-20257 #
CONF-800972-6 N81-20936 #
CONF-800979-12 N81-20902 #
CONF-800980-35 N81-20367 #
CONF-801011-74 N81-20300 #
CONF-801022 N81-20561 #
CONF-801072-4-REV N81-20448 #
CONF-801103-28 N81-20855 #
CONF-801103-49 N81-20410 #
CONF-801104-10 N81-20294 #
CONF-801107-45 N81-20228 #
CONF-801111-6 N81-20859 #
CONF-801111-8 N81-20420 #
CONF-801124-33 N81-20858 #
CONF-801134-13 N81-20938 #
CONF-801138-7 N81-20860 #
CONF-801139-1 N81-20233 #
CONF-801150-1 N81-20953 #
CONF-801160-2 N81-20613 #
CONF-801201-3 N81-20872 #
CONF-801201-4 N81-20847 #
CONF-801210-16 N81-20181 #
CONF-801215-5 N81-20895 #
CONF-801215-6 N81-20896 #
CONF-801218-4 N81-20586 #
CONF-810106-2 N81-20401 #
CONF-810107-1 N81-20848 #
CONF-810108-1 N81-20279 #
CONF-810203-1 N81-20262 #
CONF-810204-1 N81-20873 #
CONF-810301-1-REV N81-20261 #
CONF-810301-2 N81-20191 #
CONF-810306-4 N81-20678 #
CONF-8005102 N81-20856 #
CONF-8006127-4 N81-20849 #
CONF-8006130-2 N81-20259 #
CONF-8006142-1 N81-20834 #
CONF-8006150-1 N81-20939 #
CONF-8010120 N81-20439 #
CONF-8010121-1 N81-20303 #
CONF-8010124-1 N81-20472 #
CONF-8010126-1 N81-20301 #
CONF-8010132-1 N81-20857 #
CONF-8010135-1 N81-20229 #
CONF-8010135-2 N81-20612 #
CONF-8010135-4 N81-20616 #
COO-2218-195 N81-20902 #
COO-2296-22 N81-20474 #
COO-2982-57 N81-20306 #
COO-3072-119 N81-20410 #
COO-4831-3 N81-20846 #
COO-10591-1 N81-20280 #
CORADCOM-74-C-0771-F N81-20871 #
CORADCOM-78-2922-3 N81-20870 #
CRC-1338-E N81-20326 #
CRC-1340 N81-20325 #
CRWR-171 N81-20316 #
D-210-11788-1 N81-20027* #
DELET-TR-78-2977-F N81-20364 #
DELET-TR-79-0273-F N81-20365 #
DFVLR-MITT-80-09 N81-20007 #
DFVLR-MITT-80-12 N81-20681 #
DFVLR-MITT-80-13 N81-20088 #
DFVLR-MITT-80-14 N81-20058 #
DH-RS-01 N81-20374 #
DNA-3964F-2-1 N81-20742 #
DOE/AF-10001/T2 N81-20293 #
DOE/CS-20080/5120-VOL-2 N81-20398 #
DOE/CS-30108/T3 N81-20567 #
DOE/CS-35351/T1 N81-20568 #
DOE/CS-35405/T1 N81-20574 #
DOE/CS-40023/T1 N81-20441 #
DOE/CS-40213/T1 N81-20231 #
DOE/ER-0090 N81-20598 #
DOE/ER-01198/1325 N81-20256 #
DOE/ER-01388/464 N81-20840 #
DOE/ER-02232/92 N81-20853 #
DOE/ER-02232/94 N81-20842 #
DOE/ER-02887/2 N81-20850 #
DOE/ER-03898/52 N81-20854 #
DOE/ER-10161/1 N81-20349 #
DOE/ER-10367/T3 N81-20400 #
DOE/ER-10396/2 N81-20419 #
DOE/ER-10591/1 N81-20280 #
DOE/ER-70004/266 N81-20845 #
DOE/ET-03297/1 N81-20295 #
DOE/ET-10104/T11 N81-20308 #
DOE/ET-10296/66-VOL-1 N81-20296 #
DOE/ET-10328/27 N81-20304 #
DOE/ET-10527/T1 N81-20292 #
DOE/ET-10571/3 N81-20264 #
DOE/ET-12548/4 N81-20495* #
DOE/ET-15303/T5 N81-20236 #
DOE/ET-15422/5 N81-20560 #
DOE/ET-15602/T2 N81-20590 #
DOE/ET-23006/4 N81-20593 #
DOE/ET-28502/1 N81-20680 #
DOE/ET-29345/21 N81-20591 #
DOE/ET-33056/15 N81-20594 #
DOE/ET-51017/T1 N81-20894 #

DOE/ET-52002/T1 ..... N81-20900 #
DOE/ET-52025/3 ..... N81-20906 #

DOE/FE-0010 ..... N81-20297 #

DOE/FF-02170/T58 ..... N81-20475 #

DOE/JPL-1012-50 ..... N81-20546* #
DOE/JPL-1012-51 ..... N81-20545* #
DOE/JPL-1012-52 ..... N81-20544* #
DOE/JPL-1060-40 ..... N81-20547* #
DOE/JPL-955456-1 ..... N81-20538* #
DOE/JPL-955456-1 ..... N81-20539* #
DOE/JPL-955456-1 ..... N81-20540* #
DOE/JPL-955456-1 ..... N81-20541* #
DOE/JPL-955456-1 ..... N81-20542* #

DOE/NASA/0106-1 ..... N81-20958* #

DOE/PC-30252/T1 ..... N81-20227 #

DOE/RA-10157/1 ..... N81-20702 #
DOE/RA-26961/01 ..... N81-20575 #
DOE/RA-29323/1 ..... N81-20833 #

DOE/R5-10130/2 ..... N81-20566 #

DOE/SF-20235/T1-VOL-4 ..... N81-20689 #

DOE/TIC-3382 ..... N81-20677 #
DOE/TIC-11303 ..... N81-20525 #
DOE/TIC-11357 ..... N81-20571 #
DOE/TIC-11384 ..... N81-20587 #

DOT-P-10-80-18 ..... N81-20961 #

DOT-TSC-UMTA-80-23 ..... N81-20960 #

DPSPU-80-30-7 ..... N81-20228 #

DRES-MEMO-1001 ..... N81-20225 #

DRSMI-RE-CR-81-7 ..... N81-20348 #

DRSMI-RS-81-2-TR ..... N81-20152 #

DTIC/TR-81/1 ..... N81-20952 #

D6-46691 ..... N81-20062* #
D33-1980 ..... N81-20317 #
D35-1980 ..... N81-20605 #

E-410-2 ..... N81-20275* #
E-449 ..... N81-20245* #
E-484 ..... N81-20423* #
E-536 ..... N81-20173* #
E-540 ..... N81-20076* #
E-553 ..... N81-20176* #
E-582 ..... N81-20359* #
E-727 ..... N81-20172* #
E-765 ..... N81-20177* #
E-772 ..... N81-20179* #
E-778 ..... N81-20424* #
E-797 ..... N81-20831* #
E-802 ..... N81-20178* #
E-813 ..... N81-20180* #

EAC-R-4015 ..... N81-20596 #

EDA-ERD-80-169 ..... N81-20315 #

EE-8119 ..... N81-20760* #

EECS-TR-81-2 ..... N81-20346 #

EES-304 ..... N81-20530 #

EGG-FT-5281 ..... N81-20903 #

EGG-IS-5187 ..... N81-20449 #

EMRL-76 ..... N81-20248 #

EPA-AA-CTAB/PA-80-5 ..... N81-20620 #

EPA-600/2-80-195 ..... N81-20622 #
EPA-600/2-80-203 ..... N81-20618 #
EPA-600/2-80-204 ..... N81-20182 #
EPA-600/4-80-051 ..... N81-20531 #
EPA-600/7-80-129 ..... N81-20690 #

EPRI-AP-1599-VOL-2 ..... N81-20434 #

EPRI-CS-1517-VOL-5 ..... N81-20302 #
EPRI-CS-1604 ..... N81-20438 #

EPRI-NP-1640 ..... N81-20470 #

ERADCOM/ASL-CR-80-0001-1 ..... N81-20341 #
ERADCOM/ASL-CR-80-0008-4 ..... N81-20644 #

ERDA-TR-75 ..... N81-20263 #

ERIM-134400-11-F-VOL-2 ..... N81-20688 #

ESA-CR(P)-1243 ..... N81-20374 #
ESA-CR(P)-1379 ..... N81-20104 #
ESA-CR(P)-1380 ..... N81-20165 #
ESA-CR(P)-1381-VOL-1 ..... N81-20989 #
ESA-CR(P)-1381-VOL-2 ..... N81-20990 #
ESA-CR(P)-1382-VOL-1 ..... N81-20603 #
ESA-CR(P)-1386-VOL-1 ..... N81-20105 #
ESA-CR(P)-1386-VOL-2 ..... N81-20106 #
ESA-CR(P)-1388 ..... N81-20766 #
ESA-CR(P)-1390 ..... N81-20526 #
ESA-CR(P)-1391 ..... N81-20153 #
ESA-CR(P)-1395 ..... N81-20309 #
ESA-CR(P)-1397 ..... N81-20154 #

ESA-STM-206 ..... N81-20954 #
ESA-STM-215 ..... N81-20284 #

ESL-710816-9 ..... N81-20345 #

ESRO-TN-120 ..... N81-20954 #

ESS/CCG-118-VOL-1 ..... N81-20989 #
ESS/CCG-118-VOL-2 ..... N81-20990 #

ESS/SS-987-VOL-1 ..... N81-20603 #

EUR-6764-FR ..... N81-20299 #

FAA-CT-80-19 ..... N81-20056 #

FAA-RD-80-117 ..... N81-20055 #

FE-1806-96 ..... N81-20440 #
FE-2729-11 ..... N81-20232 #

FFA-TN-AU-1600 ..... N81-20036 #

FFA-TN-HU-2127 ..... N81-20481 #
FFA-TN-HU-2127-PT-3 ..... N81-20192 #

FFA-133 ..... N81-20037 #

FHWA/CA/TL-80-20 ..... N81-20286 #

FHWA/OH-80/005 ..... N81-20530 #

FOA-C-20368-T1 ..... N81-20648 #

FR-11 ..... N81-20733* #
FR-13983 ..... N81-20078* #

FRI-R664 ..... N81-20309 #

F78-11-VOL-2-REV-A ..... N81-20491* #

GA-A-16054 ..... N81-20191 #

GAO/MASAD-81-3 ..... N81-20069 #

GDC-ASP-80-007-VOL-1 ..... N81-20462* #
GDC-ASP-80-007-VOL-2 ..... N81-20463* #

GEC-TRANS-2071 ..... N81-20265 #

GLERL-CONTRIB-222 ..... N81-20532 #

GRC-CR-1-520-VOL-2-1 ..... N81-20742 #

H-1133 ..... N81-20074* #

HONEYWELL-80SRC73 ..... N81-20869 #

IAE-3198 ..... N81-20905 #

IITR-M6062 ..... N81-20190 #

INCO/1138A-1080-TR-47-D/F ..... N81-20749 #

INFORMATION-5 ..... N81-20571 #

INPE-1935-RPE/258 ..... N81-20636 #
INPE-1940-RPE/259 ..... N81-21001 #
INPE-1941-RPE/260 ..... N81-20635 #
INPE-1942-RPE/261 ..... N81-20216 #
INPE-1946-RPE/263 ..... N81-20650 #
INPE-1948-RPE/265 ..... N81-20662 #
INPE-1950-RPE/266 ..... N81-20358 #
INPE-1956-RPE/270 ..... N81-20049 #
INPE-1957-RPE/271 ..... N81-20634 #
INPE-1958-RPE/272 ..... N81-21005 #
INPE-1959-RPE/273 ..... N81-20995 #
INPE-1962-RPE/275 ..... N81-20942 #
INPE-1966-RPE/277 ..... N81-20661 #
INPE-1974-RPE/279 ..... N81-20659 #
INPE-1985-RPE/282 ..... N81-20663 #

IPPJ-AM-16 ..... N81-20888 #

IR-24 ..... N81-20184* #
IR-34 ..... N81-20308 #
IR-663 ..... N81-20747 #

IS-M-305 ..... N81-20262 #

ISBN-91-540-3321-7 ..... N81-20317 #
ISBN-91-540-3329-2 ..... N81-20605 #
ISBN-92-835-0260-9 ..... N81-20603 #
ISBN-92-835-1375-4 ..... N81-20461 #
ISBN-92-835-1377-0 ..... N81-20091 #
ISBN-92-835-1379-7 ..... N81-20064 #

ISSN-SW-0081-5640 ..... N81-20037 #

ISSN-0110-1692 ..... N81-20562 #
ISSN-0170-1339 ..... N81-20375 #
ISSN-0170-1339 ..... N81-20649 #
ISSN-0170-1339 ..... N81-20650 #
ISSN-0244-8041 ..... N81-20106 #
ISSN-0340-7608 ..... N81-20266 #
ISSN-0340-7608 ..... N81-20267 #
ISSN-0340-7608 ..... N81-20268 #
ISSN-0340-7608 ..... N81-20281 #
ISSN-0340-7608 ..... N81-20282 #
ISSN-0340-7608 ..... N81-20283 #
ISSN-0340-7608 ..... N81-20369 #
ISSN-0340-7608 ..... N81-20370 #
ISSN-0340-7608 ..... N81-20371 #
ISSN-0340-7608 ..... N81-20372 #
ISSN-0340-7608 ..... N81-20373 #
ISSN-0340-7608 ..... N81-20422 #
ISSN-0340-7608 ..... N81-20443 #
ISSN-0340-7608 ..... N81-20478 #
ISSN-0340-7608 ..... N81-20600 #
ISSN-0340-7608 ..... N81-20601 #
ISSN-0340-7608 ..... N81-20617 #
ISSN-0340-7608 ..... N81-20874 #
ISSN-0340-7608 ..... N81-20875 #
ISSN-0340-7608 ..... N81-20876 #
ISSN-0340-7608 ..... N81-20877 #
ISSN-0340-7608 ..... N81-20940 #
ISSN-0348-7539 ..... N81-20651 #
ISSN-0348-7539 ..... N81-20909 #
ISSN-0348-7644 ..... N81-20910 #
ISSN-0379-4075 ..... N81-20284 #

ISU-ERI-AMES-81104 ..... N81-20079* #

ITEK-9555-80-939 ..... N81-20865* #

JPL-PUB-80-88 ..... N81-20168* #
JPL-PUB-80-93 ..... N81-20339* #
JPL-PUB-80-100 ..... N81-20545* #
JPL-PUB-81-1 ..... N81-20546* #
JPL-PUB-81-2 ..... N81-20547* #
JPL-PUB-81-4 ..... N81-20686* #
JPL-PUB-81-11 ..... N81-20495* #
JPL-PUB-81-12 ..... N81-20544* #
JPL-PUB-81-18 ..... N81-20548* #

JPL-9950-419 ..... N81-20538* #
JPL-9950-419 ..... N81-20539* #
JPL-9950-419 ..... N81-20540* #
JPL-9950-419 ..... N81-20541* #
JPL-9950-419 ..... N81-20542* #

KEO-13 ..... N81-20647 #

L-12403 ..... N81-20311* #
L-13623 ..... N81-20082* #
L-14140 ..... N81-20492* #
L-14168 ..... N81-20025* #
L-14174 ..... N81-20083* #
L-14198 ..... N81-20084* #
L-14213 ..... N81-20026* #
L-14256 ..... N81-20830* #
L-14327 ..... N81-20405* #
L-14330 ..... N81-20050* #

LA-UR-80-2798 ..... N81-20233 #
LA-UR-80-2822 ..... N81-20859 #
LA-UR-80-2854 ..... N81-20303 #
LA-UR-80-2858 ..... N81-20472 #
LA-UR-80-2930 ..... N81-20936 #
LA-UR-80-3187 ..... N81-20420 #
LA-UR-80-3238 ..... N81-20896 #
LA-UR-80-3453 ..... N81-20586 #
LA-UR-80-3459 ..... N81-20847 #
LA-UR-80-3476 ..... N81-20849 #
LA-UR-80-3507 ..... N81-20860 #
LA-UR-80-3585 ..... N81-20181 #
LA-UR-80-3621 ..... N81-20873 #
LA-UR-80-3658 ..... N81-20848 #
LA-UR-80-3674 ..... N81-20872 #
LA-UR-81-110 ..... N81-20613 #

LA-7755-PR ..... N81-20901 #
LA-8517-MS ..... N81-20260 #
LA-8562-MS ..... N81-20580 #
LA-8572-MS ..... N81-20732 #

LBL-PUB-350 ..... N81-20576 #

LBL-6497 ..... N81-20614 #
LBL-10341-REV ..... N81-20448 #
LBL-11339 ..... N81-20230 #
LBL-11341-REV ..... N81-20261 #
LBL-11605 ..... N81-20367 #
LBL-11651 ..... N81-20857 #
LBL-11676 ..... N81-20616 #
LBL-11677 ..... N81-20612 #
LBL-11678 ..... N81-20229 #
LBL-11680 ..... N81-20938 #
LBL-11776 ..... N81-20298 #

LC-79-16727 ..... N81-20489* #
LC-80-600148 ..... N81-20412 #
LC-80-60000205 ..... N81-20323 #
LC-80-60000206 ..... N81-20322 #

LEP-80.638.SME-689-A ..... N81-20602 #

LG80ER0013-VOL-1 ..... N81-20047 #
LG80ER0013-VOL-2 ..... N81-20046 #

LIDS-TH-1064 ..... N81-20762 #

LMI-ML010 ..... N81-20290 #

M-989-81 ..... N81-20164* #

MA-ARO-F1 ..... N81-20347 #

MATH-RES-143-PT-2 ..... N81-20944 #
MATH-RES-146 ..... N81-20945 #
MATH-RES-147-PT-3 ..... N81-20946 #
MATH-RES-148 ..... N81-20783 #
MATH-RES-149 ..... N81-20784 #
MATH-RES-153 ..... N81-20801 #

MC-IW-131/80 ..... N81-20781 #

MDC-G9346 ..... N81-20146* #

MDC-Q0717 ..... N81-20863* #

MERADCOM-2314 ..... N81-20959 #

MHSMP-80-55 ..... N81-20307 #
MHSMP-80-63 ..... N81-20235 #

MIMEO-SER-1327 ..... N81-20772 #

MIT-TR-207 ..... N81-20086* #

MLM-2796(OP) ..... N81-20279 #

MML-TR-81-6C ..... N81-20468 #

MMS-1319 ..... N81-20793 #

MSNW-81-1158-1 ..... N81-20908 #

MSRR-470 ..... N81-20775 #

MTR-3833 ..... N81-20737 #

NADC-13920-2 ..... N81-20070 #
NADC-80198-60 ..... N81-20250 #
NADC-80202-60 ..... N81-20467 #

NASA-CASE-NPO-13970-1 ..... N81-20352* #
NASA-CASE-NPO-14329-1 ..... N81-20703* #

NASA-CR-3305 ..... N81-20062* #
NASA-CR-3389 ..... N81-20383* #
NASA-CR-3397 ..... N81-20537* #
NASA-CR-3401 ..... N81-20664* #
NASA-CR-3404 ..... N81-20312* #
NASA-CR-152378 ..... N81-20063* #
NASA-CR-156875 ..... N81-20406* #
NASA-CR-159262 ..... N81-20067* #
NASA-CR-159375 ..... N81-20185* #
NASA-CR-160061 ..... N81-20864* #
NASA-CR-160897 ..... N81-20731* #
NASA-CR-160898 ..... N81-20327* #
NASA-CR-160902 ..... N81-20797* #
NASA-CR-160921 ..... N81-20328* #
NASA-CR-160922 ..... N81-20722* #
NASA-CR-160923 ..... N81-20324* #
NASA-CR-160929 ..... N81-20157* #
NASA-CR-160929 ..... N81-20158* #
NASA-CR-160932 ..... N81-20463* #
NASA-CR-160933 ..... N81-20462* #
NASA-CR-160934 ..... N81-20146* #
NASA-CR-160936 ..... N81-20707* #
NASA-CR-160937 ..... N81-20865* #
NASA-CR-161598 ..... N81-20863* #
NASA-CR-161663 ..... N81-20665* #
NASA-CR-161664 ..... N81-20667* #
NASA-CR-161672 ..... N81-20425* #
NASA-CR-161673 ..... N81-20382* #
NASA-CR-161674 ..... N81-20102* #
NASA-CR-161676 ..... N81-20666* #
NASA-CR-161677 ..... N81-20175* #
NASA-CR-161678 ..... N81-20101* #
NASA-CR-163989 ..... N81-20639* #
NASA-CR-163992 ..... N81-20760* #
NASA-CR-163993 ..... N81-20184* #
NASA-CR-163995 ..... N81-20079* #
NASA-CR-164051 ..... N81-20538* #
NASA-CR-164052 ..... N81-20539* #
NASA-CR-164053 ..... N81-20542* #
NASA-CR-164054 ..... N81-20540* #
NASA-CR-164055 ..... N81-20541* #
NASA-CR-164056 ..... N81-20638* #
NASA-CR-164057 ..... N81-20065* #
NASA-CR-164059 ..... N81-20761* #
NASA-CR-164060 ..... N81-20107* #
NASA-CR-164061 ..... N81-21002* #
NASA-CR-164062 ..... N81-20276* #
NASA-CR-164063 ..... N81-20641* #
NASA-CR-164064 ..... N81-20733* #
NASA-CR-164065 ..... N81-20186* #
NASA-CR-164066 ..... N81-20637* #
NASA-CR-164072 ..... N81-20999* #
NASA-CR-164073 ..... N81-20545* #
NASA-CR-164074 ..... N81-20546* #
NASA-CR-164075 ..... N81-20495* #
NASA-CR-164076 ..... N81-20168* #
NASA-CR-164077 ..... N81-20339* #
NASA-CR-164078 ..... N81-20548* #
NASA-CR-164079 ..... N81-20465* #
NASA-CR-164080 ..... N81-20998* #
NASA-CR-164082 ..... N81-20052* #
NASA-CR-164082 ..... N81-20053* #
NASA-CR-164083 ..... N81-20544* #
NASA-CR-164084 ..... N81-20189* #
NASA-CR-164087 ..... N81-20686* #
NASA-CR-164088 ..... N81-20547* #
NASA-CR-165170 ..... N81-20958* #
NASA-CR-165233 ..... N81-20174* #
NASA-CR-165261 ..... N81-20078* #
NASA-CR-165292 ..... N81-20244* #
NASA-CR-165655 ..... N81-20028* #
NASA-CR-165660 ..... N81-20086* #
NASA-CR-165666 ..... N81-20027* #
NASA-CR-165674 ..... N81-20051* #
NASA-CR-165680 ..... N81-20068* #

NASA-CR-166643 ..... N81-20360* #
NASA-CR-166646 ..... N81-20338* #
NASA-CR-166647 ..... N81-20147* #
NASA-CR-166649 ..... N81-20491* #
NASA-CR-166655 ..... N81-20166* #
NASA-CR-166658 ..... N81-20337* #

NASA-EP-171 ..... N81-20947* #

NASA-NEWS-RELEASE-81-39 ..... N81-20156*

NASA-SP-431 ..... N81-20489* #
NASA-SP-4211 ..... N81-20962* #
NASA-SP-7011(216) N81-20704*
NASA-SP-7037(132) N81-20005*
NASA-SP-7041(28) N81-20486*

NASA-TM-75404 ..... N81-20543* #
NASA-TM-75844 ..... N81-20889* #
NASA-TM-75859 ..... N81-20802* #
NASA-TM-75866 ..... N81-20188* #
NASA-TM-75869 ..... N81-20867* #
NASA-TM-75888 ..... N81-20725* #
NASA-TM-75889 ..... N81-20728* #
NASA-TM-75901 ..... N81-20217* #
NASA-TM-75907 ..... N81-20031* #
NASA-TM-75911 ..... N81-20866* #
NASA-TM-75939 ..... N81-20695* #
NASA-TM-75988 ..... N81-20694* #
NASA-TM-75992 ..... N81-20691* #
NASA-TM-76001 ..... N81-20716* #
NASA-TM-76053 ..... N81-20724* #
NASA-TM-76067 ..... N81-20696* #
NASA-TM-76148 ..... N81-20697* #
NASA-TM-76150 ..... N81-20727* #
NASA-TM-76168 ..... N81-20698* #
NASA-TM-76169 ..... N81-20699* #
NASA-TM-76175 ..... N81-20693* #
NASA-TM-76287 ..... N81-20700* #
NASA-TM-76340 ..... N81-20721* #
NASA-TM-76370 ..... N81-20717* #
NASA-TM-76374 ..... N81-20720* #
NASA-TM-76386 ..... N81-20718* #
NASA-TM-76391 ..... N81-20103* #
NASA-TM-76396 ..... N81-20692* #
NASA-TM-76398 ..... N81-20719* #
NASA-TM-76404 ..... N81-20713* #
NASA-TM-76471 ..... N81-20714* #
NASA-TM-76472 ..... N81-20701* #
NASA-TM-76476 ..... N81-20715* #
NASA-TM-76492 ..... N81-20144* #
NASA-TM-76493 ..... N81-20956* #
NASA-TM-76519 ..... N81-20726* #
NASA-TM-76523 ..... N81-20187* #
NASA-TM-76532 ..... N81-20609* #
NASA-TM-76542 ..... N81-20723* #
NASA-TM-80718 ..... N81-20988* #
NASA-TM-80729 ..... N81-20493* #
NASA-TM-80732 ..... N81-20494* #
NASA-TM-80738 ..... N81-21006* #
NASA-TM-81251 ..... N81-21000* #
NASA-TM-81256 ..... N81-20006* #
NASA-TM-81258 ..... N81-20030* #
NASA-TM-81259 ..... N81-20384* #
NASA-TM-81264 ..... N81-20029* #
NASA-TM-81281 ..... N81-20066* #
NASA-TM-81702 ..... N81-20172* #
NASA-TM-81709 ..... N81-20275* #
NASA-TM-81725 ..... N81-20177* #
NASA-TM-81726 ..... N81-20424* #
NASA-TM-81729 ..... N81-20179* #
NASA-TM-81734 ..... N81-20178* #
NASA-TM-81751 ..... N81-20831* #
NASA-TM-81770 ..... N81-20180* #
NASA-TM-81797 ..... N81-20741* #
NASA-TM-81860-2 ..... N81-20608* #
NASA-TM-81909 ..... N81-20084* #
NASA-TM-81915 ..... N81-20830* #
NASA-TM-81929 ..... N81-20083* #
NASA-TM-81937 ..... N81-20025* #
NASA-TM-81945 ..... N81-20050* #
NASA-TM-81946 ..... N81-20668* #
NASA-TM-81948 ..... N81-20085* #
NASA-TM-81950 ..... N81-20949* #
NASA-TM-81953 ..... N81-20405* #
NASA-TM-81955 ..... N81-20336* #
NASA-TM-81957 ..... N81-20167* #
NASA-TM-81959 ..... N81-20044* #
NASA-TM-82074 ..... N81-20490* #
NASA-TM-82077 ..... N81-20658* #

NASA-TM-82082 ..... N81-20994* #
NASA-TM-82095 ..... N81-20996* #
NASA-TM-82281 ..... N81-20997* #
NASA-TM-82320 ..... N81-20947* #
NASA-TM-82321 ..... N81-20164* #
NASA-TM-82386 ..... N81-20100* #
NASA-TM-82403 ..... N81-20289* #
NASA-TM-82407 ..... N81-20868* #

NASA-TP-1710 ..... N81-20423* #
NASA-TP-1765 ..... N81-20082* #
NASA-TP-1799 ..... N81-20311* #
NASA-TP-1810 ..... N81-20076* #
NASA-TP-1811 ..... N81-20173* #
NASA-TP-1821 ..... N81-20492* #
NASA-TP-1830 ..... N81-20074* #
NASA-TP-1834 ..... N81-20176* #
NASA-TP-1835 ..... N81-20245* #
NASA-TP-1836 ..... N81-20359* #
NASA-TP-1837 ..... N81-20026* #

NBS/DIM-64/8 ..... N81-21007 #

NBS/SP-596 ..... N81-20412 #

NBSIR-80-2133 ..... N81-20955 #
NBSIR-80-2144 ..... N81-20606 #
NBSIR-80-2161 ..... N81-20318 #

NCSU-OR-171 ..... N81-20799 #

ND-R-471(R) ..... N81-20471 #

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NLR-MP-79035-U ..... N81-20527 #
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NLR-MP-80004-U ..... N81-20038 #
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NLR-TR-78110-U-VOL-1 ..... N81-20450 #
NLR-TR-78110-U-VOL-2 ..... N81-20451 #
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NOAA-TM-ERL-GLERL-27 ..... N81-20532 #

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NOAA-80081802 ..... N81-20652 #
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NOAA-80100803 ..... N81-21003 #
NOAA-80102802 ..... N81-20654 #
NOAA-80110401 ..... N81-20532 #
NOAA-80110407 ..... N81-20682 #

NOAA/TM/ERL/RFC-6 ..... N81-20682 #

NOSC/TR-628 ..... N81-20795 #
NOSC/TR-629 ..... N81-20643 #

NP-25187-VOL-1 ..... N81-20563 #
NP-25187-VOL-2 ..... N81-20564 #

NPS67-80-011 ..... *N81-20892* #

NRCAA-79-LASBR-002 ..... N81-20418 #

NRL-MR-4380 ..... N81-20415 #
NRL-MR-4390 ..... N81-20407 #
NRL-MR-4392 ..... *N81-20340* #
NRL-MR-4410 ..... N81-20891 #
NRL-MR-4413 ..... N81-20832 #
NRL-MR-4426 ..... N81-20361 #
NRL-MR-4434 ..... *N81-20416* #
NRL-MR-4444 ..... N81-20687 #
NRL-MR-4452 ..... N81-20246 #
NRL-MR-4461 ..... *N81-20524* #
NRL-MR-4463 ..... N81-20417 #
NRL-MR-4484 ..... N81-20466 #

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PB81-120784 ..... N81-20622 #
PB81-120826 ..... N81-20961 #
PB81-120875 ..... N81-20960 #
PB81-121154 ..... N81-20618 #
PB81-121253 ..... N81-20621 #
PB81-122269 ..... N81-20403 #
PB81-122301 ..... N81-20483 #
PB81-122343 ..... N81-20404 #
PB81-122871 ..... N81-20317 #
PB81-122996 ..... N81-20620 #
PB81-123200 ..... N81-20351 #
PB81-123242 ..... N81-20485 #
PB81-123523 ..... N81-20619 #
PB81-123671 ..... N81-20452 #
PB81-123697 ..... N81-20314 #
PB81-124141 ..... N81-20535 #
PB81-124448 ..... N81-20529 #
PB81-124885 ..... N81-20484 #
PB81-124984 ..... N81-20412 #
PB81-125015 ..... N81-20182 #
PB81-125551 ..... N81-20653 #
PB81-125569 ..... N81-21003 #
PB81-127276 ..... N81-20534 #
PB81-127300 ..... N81-20530 #
PB81-127318 ..... N81-20533 #
PB81-127433 ..... N81-20528 #
PB81-127490 ..... N81-20690 #
PB81-128704 ..... N81-20604 #
PB81-129009 ..... N81-20531 #
PB81-129801 ..... N81-20315 #
PB81-129835 ..... N81-20286 #
PB81-132268 ..... N81-20606 #
PB81-132771 ..... N81-20682 #
PB81-132789 ..... N81-20532 #
PB81-132870 ..... N81-20955 #
PB81-132912 ..... N81-20654 #
PB81-133654 ..... N81-21007 #
PB81-135642 ..... N81-20318 #
PB81-135741 ..... N81-20605 #
PB81-136202 ..... N81-20316 #

PFC/RR80-18 ..... N81-20900 #

PHM-01-80 ..... N81-20646 #

PNL-SA-8358 ..... N81-20258 #
PNL-SA-8661 ..... *N81-20939* #
PNL-SA-8691 ..... N81-20834 #
PNL-SA-8732 ..... N81-20858 #
PNL-SA-8785 ..... *N81-20679* #

PNL-3195-WERA-4 ..... N81-20592 #
PNL-3575 ..... N81-20577 #
PNL-3629 ..... N81-20578 #

PNR-90017 ..... N81-20081 #
PNR-90042 ..... N81-20442 #

PPPL-1736 ..... N81-20421 #

PR-2 ..... N81-20761* #
PR-16 ..... N81-20545* #

PSAD-80-50 ..... N81-20077

PTPD-80-22 ..... N81-20073 #

PUB-41065 ..... N81-20534 #

PWA-FR-12598 ..... N81-20437 #
PWA-FR-13144 ..... N81-20080 #

P81-10039 ..... N81-20156*

QPR-8 ..... N81-20869 #

QR-2 ..... N81-20932 #

QTR-1 ..... N81-20145 #

RADC-TR-80-259 ..... N81-20737 #
RADC-TR-80-337 ..... N81-20054 #
RADC-TR-80-353 ..... N81-20739 #
RADC-TR-80-356 ..... N81-20950 #
RADC-TR-80-357 ..... N81-20363 #
RADC-TR-80-376 ..... N81-20749 #

RAE-AERO-3476 ..... N81-20040 #

RAE-IT-168 ..... N81-20089 #

RAE-MAT-406 ..... N81-20480 #

RAE-SPACE-584 ..... N81-20142 #

RAE-TM-MAT-349 ..... N81-20479 #

RAE-TM-RAD-NAV-138 ..... N81-20350 #

RAE-TR-80039 ..... N81-20040 #
RAE-TR-80081 ..... N81-20089 #
RAE-TR-80093 ..... N81-20142 #
RAE-TR-80098 ..... N81-20480 #

REL/R(79)28 ..... N81-20476 #

REPT-26 ..... N81-20271 #
REPT-28 ..... N81-20314 #
REPT-31-1653 ..... N81-20958* #
REPT-53 ..... *N81-20308* #
REPT-80-1-A-B ..... N81-20689 #
REPT-80-124-PT-2 ..... N81-20911 #
REPT-0002/DX60 ..... N81-20153 #
REPT-4872-6 ..... *N81-20360** #
REPT-8654-927001 ..... N81-20312* #
REPT-33553F ..... N81-20175* #
REPT-80172-OR ..... N81-20775 #

RLO-2230-T4-266 ..... N81-20845 #

RR-80-4 ..... N81-20436 #
RR-190 ..... N81-20765 #
RR-540 ..... N81-20619 #

RTCA/DO-134 ..... N81-20323 #
RTCA/DO-172 ..... N81-20322 #
RTCA/DO-173 ..... N81-20323 #

R8012-3 ..... N81-20327* #
R8012-4 ..... *N81-20157** #

SAI-79-819-HU ..... N81-20686* #

SAM-TR-80-51 ..... N81-20418 #
SAM-TR-81-1 ..... N81-20729 #

SAND-79-1623 ..... N81-20402 #
SAND-79-2173 ..... N81-20583 #
SAND-79-8185 ..... N81-20579 #
SAND-80-1177C ..... N81-20257 #
SAND-80-1363 ..... N81-20234 #
SAND-80-1446 ..... N81-20843 #
SAND-80-1909 ..... *N81-20937* #
SAND-80-2123 ..... N81-20584 #
SAND-80-2185C ..... N81-20439 #
SAND-80-2336C ..... *N81-20953* #
SAND-80-2545 ..... N81-20844 #
SAND-80-2780 ..... N81-20473 #

SAND-80-7062 ..... N81-20599 #
SAND-80-7066 ..... N81-20595 #
SAND-80-7070 ..... N81-20582 #
SAND-80-7072 ..... N81-20572 #

SASC-ADPSI-CD-013 ..... N81-20743 #

SCIENTIFIC-3 ..... N81-20670 #

SD-TR-80-81 ..... N81-20397 #

SERI/PR-8104-3-T2 ..... N81-20585 #

SERI/TR-751-652 ..... N81-20570 #

SERIAL-T-432 ..... N81-20800 #

SI-ER-915 ..... N81-20342 #

SIB-R-4-1980 ..... N81-20569 #

SKF-AT80C040 ..... N81-20435 #

SLAC-PUB-2624 ..... N81-20856 #

SOLAR/0010-80/10 ..... N81-20588 #

SP-81-04 ..... N81-20685* #

SQUID-SMU-4-PU ..... N81-20394 #
SQUID-SMU-5-PU ..... N81-20395 #

SRD-80-042-I-VOL-1 ..... N81-20538* #
SRD-80-042-II-VOL-2 ..... N81-20539* #
SRD-80-042-III-VOL-3 ..... N81-20540* #
SRD-80-042-IV-VOL-4 ..... N81-20541* #
SRD-80-042-V-VOL-5 ..... N81-20542* #
SRD-80-050 ..... N81-20147* #
SRD-81-005 ..... N81-20337* #

SRL-80-5 ..... N81-21002* #

SSD-80-0041 ..... N81-20797* #
SSD-80-0045 ..... N81-20102* #
SSD-80-0108-6-1 ..... N81-20537* #

SSS-R-40-4413 ..... N81-20150 #

STU-78-4981 ..... N81-20597 #
STU-78-6895 ..... N81-20573 #

SU-CMR-80-13 ..... N81-20931 #

SU-SEL-E718-1 ..... N81-20343 #

SU-STAN-CS-80-822 ..... N81-20744 #

SVHSER-7224 ..... N81-20731* #

TARADCOM-TR-12517 ..... N81-20247 #

TC-80-TR-0054 ..... N81-20165 #

TCRL-17 ..... N81-20079* #

TL-635150 ..... N81-20286 #

TM-78 ..... N81-20052* #
TM-79 ..... N81-20053* #

TOP-8-3-013 ..... N81-20075 #

TPI/IEA/F-7 ..... N81-20567 #

TPR-4 ..... N81-20231 #

TR-BER-4(80)DOE-720-1 ..... N81-20574 #

TR-EE80-43 ..... N81-20783 #

TR-3 ..... N81-20248 #
TR-3 ..... N81-20351 #
TR-5 ..... N81-20839 #
TR-13 ..... N81-20249 #
TR-14 ..... N81-20836 #
TR-19 ..... N81-20222 #
TR-20-80 ..... N81-20774 #
TR-21-80 ..... N81-20773 #
TR-22-80 ..... N81-20738 #
TR-80-01 ..... N81-20218 #
TR-81-1 ..... N81-20224 #
TR-112-7 ..... N81-20730 #
TR-136 ..... N81-20529 #
TR-189 ..... N81-20951 #
TR-209 ..... N81-20032 #
TR-965 ..... N81-20446 #
TR-968 ..... N81-20792 #
TR-0081(6638-05)-1 ..... N81-20397 #

TRANS-15028 ..... N81-20081 #
TRANS-15258 ..... N81-20442 #

TRITA-EPP-80-06 ..... N81-20651 #
TRITA-EPP-80-09 ..... N81-20909 #

TRITA-NA-8006 ..... N81-20782 #

TRITA-PFU-80-01 ..... N81-20890 #
TRITA-PFU-80-09 ..... N81-20910 #

TRW-ER-8037-F ..... N81-20247 #

TS-1-80-VOL-1 ..... N81-20105 #
TS-11-79-VOL-2 ..... N81-20106 #

TSC-PD-A243-1 ..... N81-20794 #

TT-76-52003 ..... N81-20263 #

TTCP/KTP3-80/1 ..... N81-20351 #

UAG-76 ..... N81-20653 #
UAG-77 ..... N81-21003 #
UAG-78 ..... N81-20654 #

UCB/EERC-80/11 ..... N81-20403 #
UCB/EERC-80/12 ..... N81-20404 #
UCB/EERC-80/15 ..... N81-20483 #
UCB/EERC-80/16 ..... N81-20484 #
UCB/EERC-80/22 ..... N81-20485 #

UCID-18572 ..... N81-20615 #
UCID-18814 ..... N81-20409 #
UCID-18825 ..... N81-20779 #
UCID-18858 ..... N81-20852 #
UCID-18879 ..... N81-20851 #
UCID-18905 ..... N81-20907 #

UCLA-ENG-8042 ..... N81-20101* #

UCONN-0507-129-F ..... N81-20221 #

UCRL-TRANS-11633 ..... N81-20905 #

UCRL-52955 ..... N81-20904 #
UCRL-52957-REV-1 ..... N81-20753 #
UCRL-53069 ..... N81-20366 #
UCRL-53086 ..... N81-20780 #
UCRL-84519 ..... N81-20401 #
UCRL-84546 ..... N81-20678 #
UCRL-85122 ..... N81-20895 #

UMTA-MA-06-0048-79-8 ..... N81-20960 #

UMTA-NY-09-0054-80-1 ..... N81-20604 #

UNC-WRRI-80-00 ..... N81-20533 #

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US-PATENT-CLASS-73-141A ..... N81-20703* #
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USAAVRADCOM19-TR-80-D-30-A ..... N81-20745 #

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USAFETAC/DS-81/004 ..... N81-20674 #
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USCG-D-41-80 ..... N81-20048 #
USCG-D-64-80 ..... N81-20220 #

UWFDM-375 ..... N81-20887 #

VI-577 ..... N81-20642 #

VKI-LEC-SER-1980-2-VOL-2 ..... N81-20549 #

VKI-LS-1980-3-VOL-2 ..... N81-20385 #
VKI-LS-1980-6 ..... N81-20426 #

VPI-E-81-4 ..... N81-20184* #

VPI-TR-EE-812 ..... N81-20761* #

VPI-TR-4 ..... N81-20796 #

WES-MP-GL-80-9 ..... N81-20750 #

W81-00279 ..... N81-20621 #
W81-00322 ..... N81-20535 #
W81-00325 ..... N81-20533 #
W81-00329 ..... N81-20529 #
W81-00506 ..... N81-20528 #
W81-00514 ..... N81-20534 #

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